Charismatic Carnivores: Cuddly Curiosities or Case Studies in Conservation?

Professor Owen T Nevin

Associate Vice-Chancellor, CQUniversity, Australia

Anniversary Visiting Professor of Conservation Biology, University of Cumbria

Yellowstone Wolves

- 1914 – US Army enlisted to support eradication
- 1926 – Last wolf killed in the park
- 1943 – Last wolf in the Greater Yellowstone Ecosystem killed
- 1944 –
- “There still remains, even in the United States, some areas of considerable size in which we feel that both red and gray [wolves] may be allowed to continue their existence with little molestation. ... Where are these areas? Probably every reasonable ecologist will agree that some of them should lie in the larger national parks and wilderness areas: for instance Yellowstone and its adjacent national forests. ... Why, in the necessary process of extirpating wolves from livestock ranges of Wyoming and Montana, were not some of the uninjured animals used to restock Yellowstone?”
  - *Aldo Leopold, 1944 The Wolves of North America*

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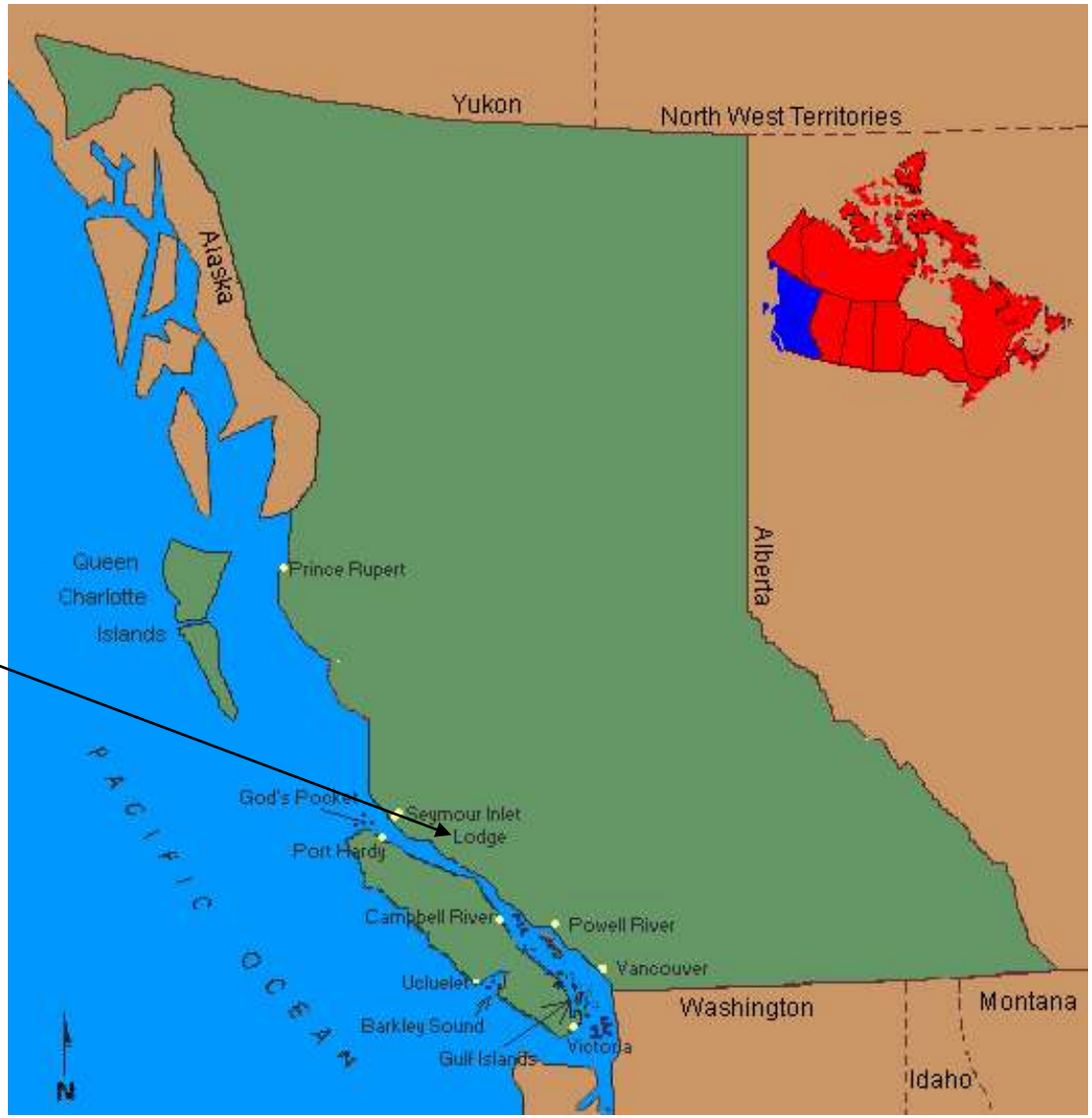
Yellowstone Wolves

- 1995/6 – Reintroduction began

British Columbia, Canada

Glendale Cove



Ecotourism as a conservation tool

- Bear viewers are:
  - Highly motivated (96% rate wildlife as important or very important in choosing a holiday)
  - Well educated (>50% have a Bachelor's, Master's or Doctoral Degree)
  - High earners (46% earn >CDN$100,000)
  - From a broad age range

- 33% would not have visited British Columbia without the opportunity to go bear viewing.

Ecotourism as a conservation tool

- Appropriately managed ecotourism has been shown to have positive impacts on bears

Results

- First study to show positive impact of ecotourism on the viewed species
  - Refuging by females with cubs
    - Consume 37% more fish when people are present
      - Drop vigilance behaviors and spend more time fishing
    - Large adult males avoid people

Implications

- Keys to success:
  - Predictable human activity patterns
  - Leave sufficient time/space for bears which avoid people

- Source-sink management
  - Viewing sites as “bear factories”

Ecotourism as a conservation tool

- Appropriately managed ecotourism has been shown to have positive impacts on bears
- Ecotourism gives land value

Ecotourism gives land value

- Economics Methodology

  (follows directives for land use planning)

  – Annual returns for average lodge: $844,610

  – Motivational revenue (indirect Provincial income): $282,530

guests * further days in BC * daily spend * % lost without bear viewing

564 * 11 * $138 * 0.33

Ecotourism gives land value

- Present Value (PV) to the Province

  (with 2.6% to profit, 25.8% to labour and 5% to capital costs) =

  $376,465 per year

  Discounted at 4% over 80 years =

  $9,348,961

Ecotourism gives land value

Bear viewing value/(Logging - Non-use benefits)

= Ha for bear viewing no net loss revenue

- High timber valued
  - $9 348 961/$33 956 per Ha = 275 hectares
- Average timber valued
  - $9 348 961/$14 995 per Ha = 1290 hectares
- Low timber valued
  - $9 348 961 / $2 330 per Ha = 4012 hectares

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Economics

- Land use planning is driven by economics not ecology
- Ecotourism income can be treated like income from extractive land use
- Tourism is an export
- Locally extremely valuable

- Why does increasing the economic value of land matter?

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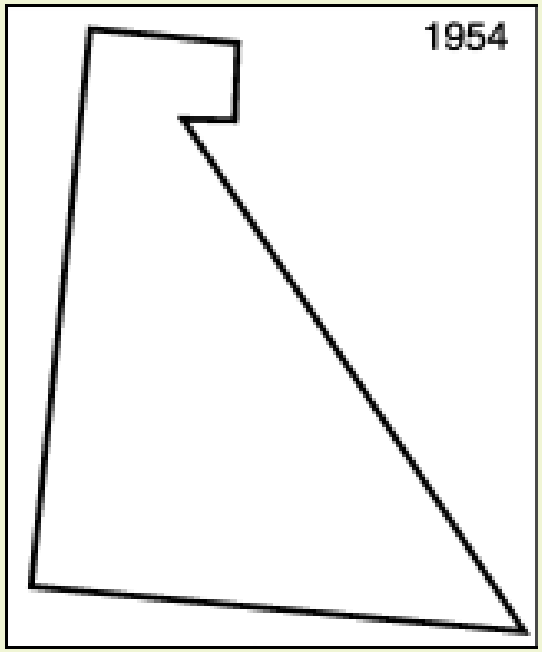
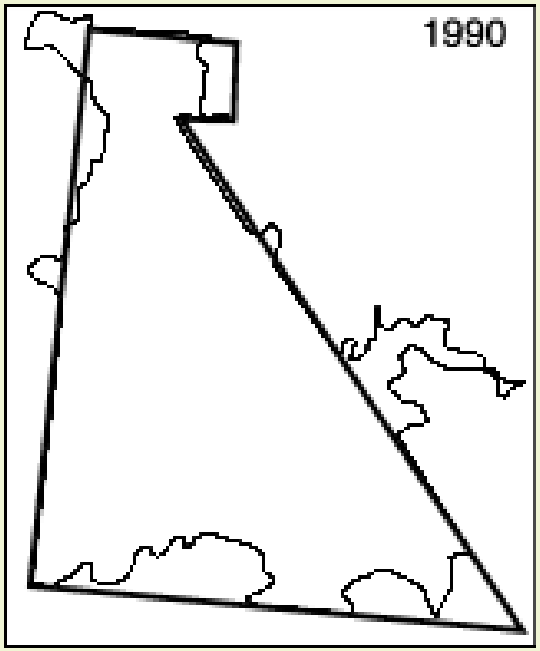
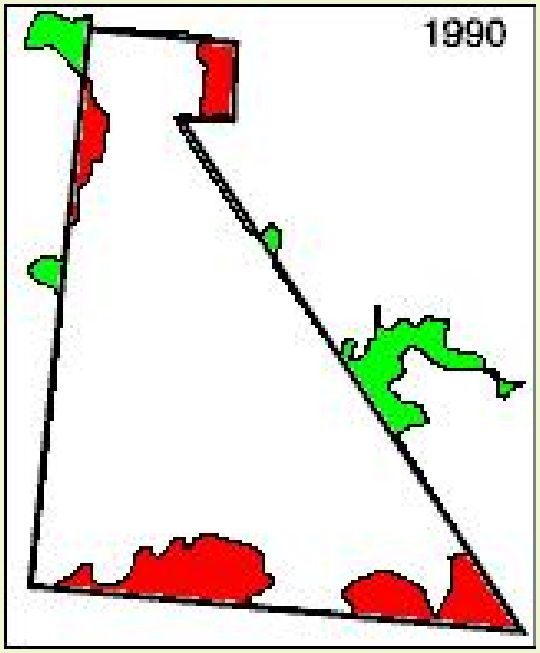
Strathcona Park, British Columbia







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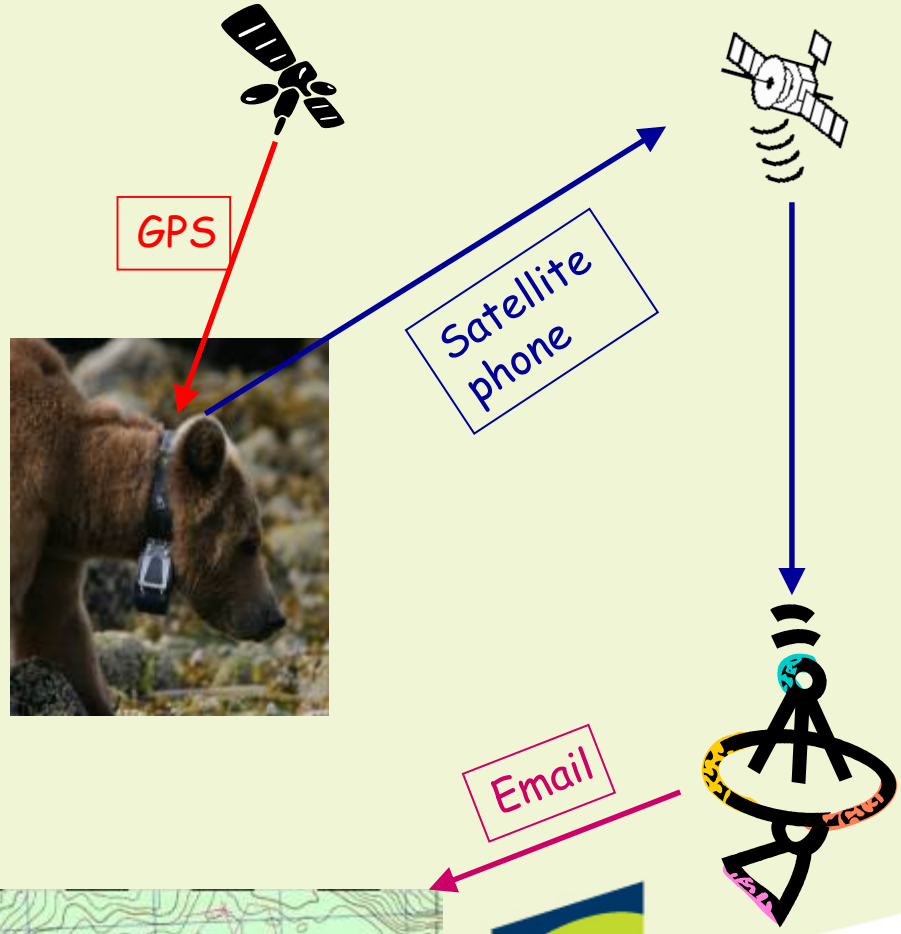
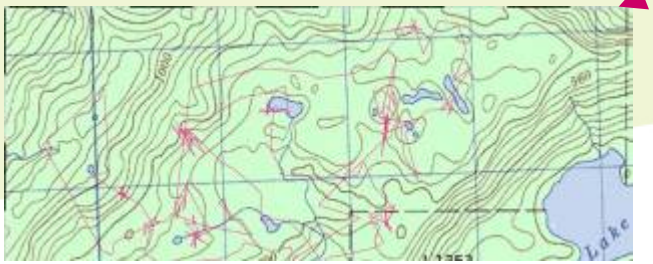
Habitat use and dispersal

Methodology

- Application of GPS and satellite communication technology in the investigation of habitat use and seasonal home range analysis





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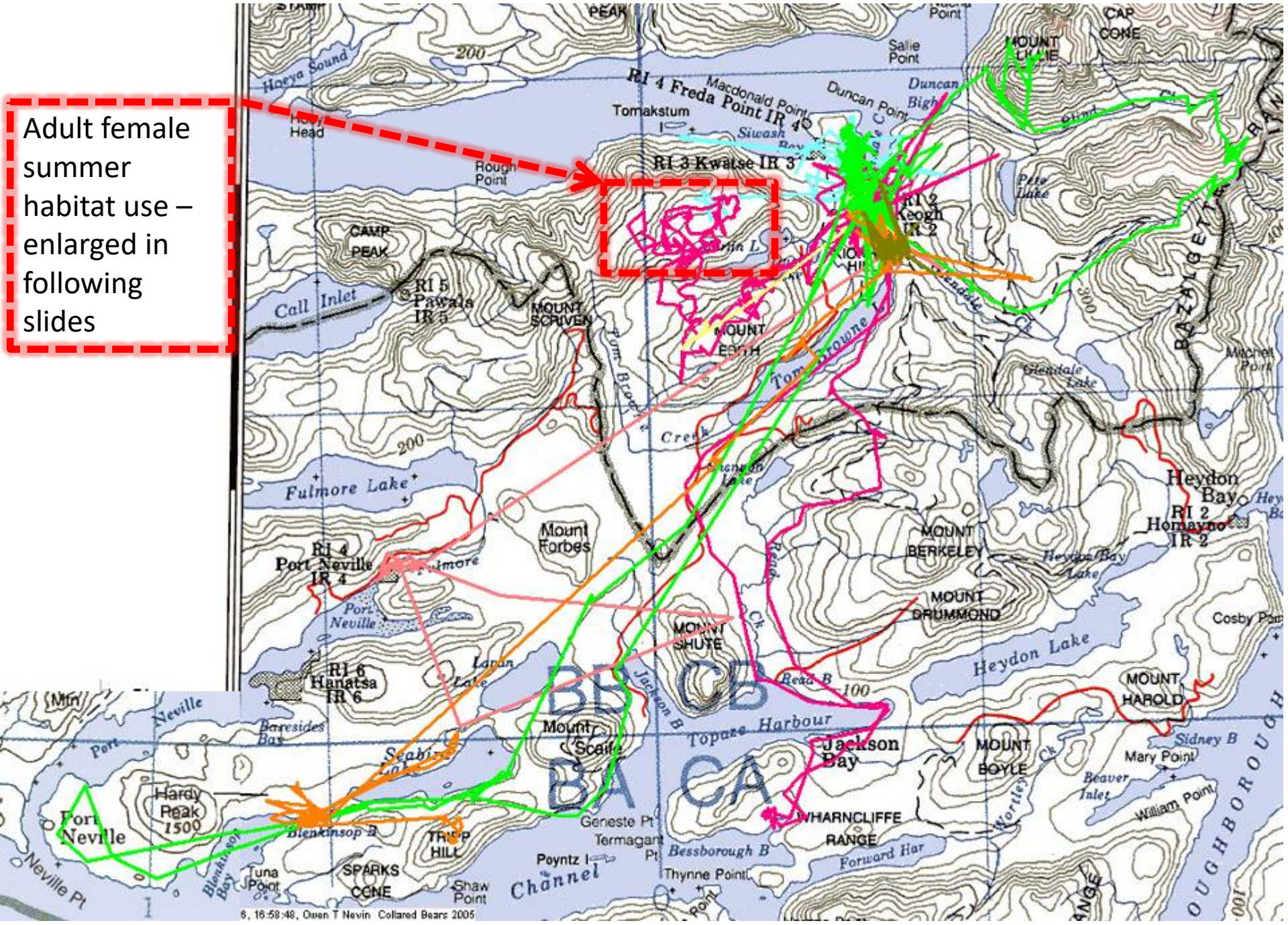
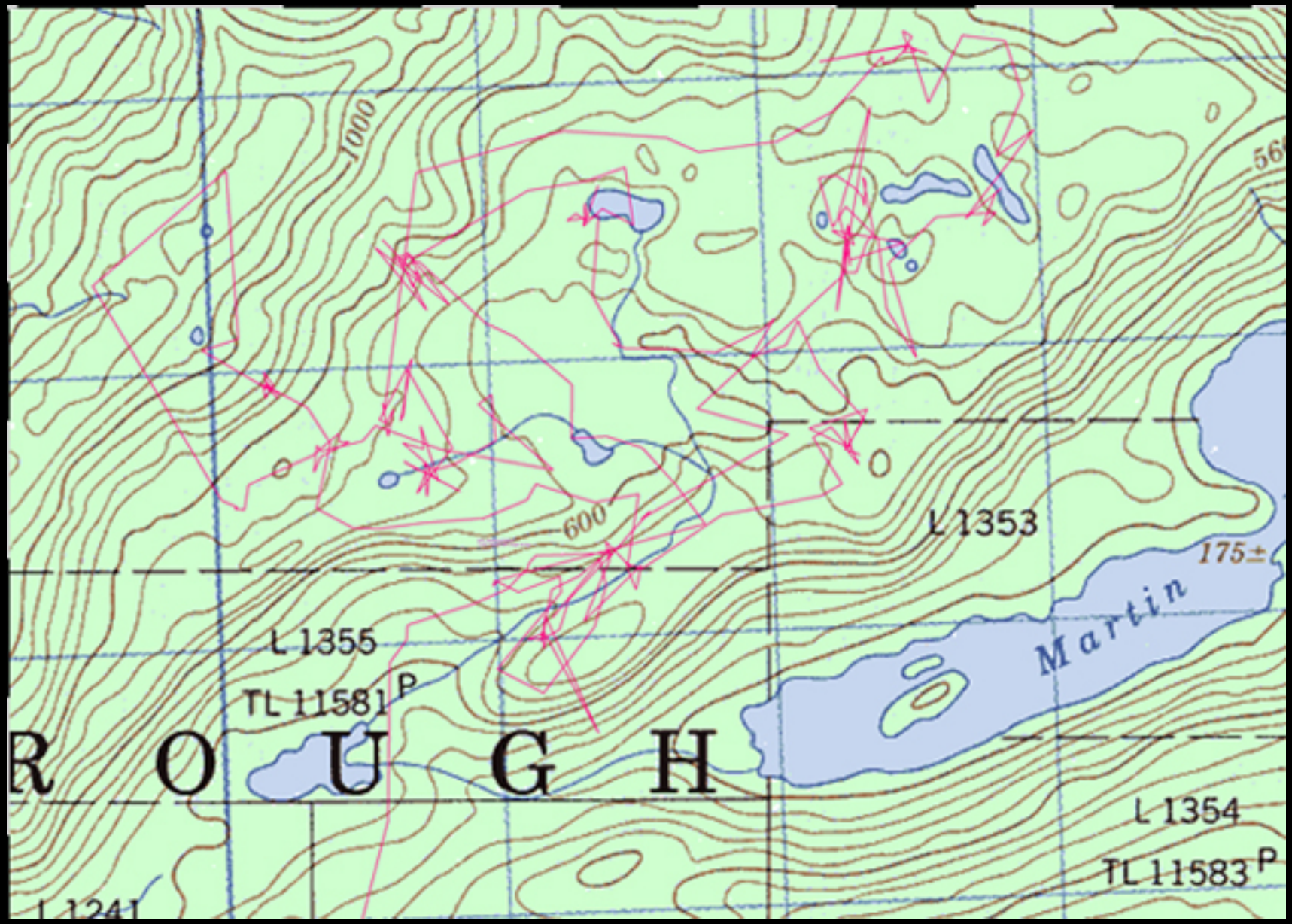

Adult female summer habitat use – enlarged in following slides
Haeya Sound
Rough Point
Tomakstum
RI 4 Freda Point IR 4
RI 3 Kwatse IR 3
Macdonald Point
Duncan Point
Sallie Point
CAP CONE
RI 2 Keogh IR 2
CAMP PEAK
RI 5 Pawala IR 5
Call Inlet
MOUNT SCRIVEN
MOUNT EDITH
Tom Browne Creek
Glendale Lake
Fulmore Lake
Mount Forbes
RI 4 Port Neville IR 4
Port Neville
RI 6 Hanatsa IR 6
Heydon Bay
RI 2 Homayno IR 2
MOUNT BERKELEY
MOUNT DRUMMOND
MOUNT SHUTE
Heydon Lake
MOUNT HAROLD
Topaze Harbour
Jackson Bay
MOUNT BOYLE
WHARNCLIFFE RANGE
Mary Point
Beaver Inlet
William Point
Sidney B
Hardy Peak 1500
Blenkinsop B
Tuna Point
SPARKS CONE
Shaw Point
Channel
Poyntz I
Thynne Point
Bessborough B
Forward Har
Geneste Pt
Termagant Pt
Neville Pt
6, 16:58:48, Owen T Nevin Collared Bears 2005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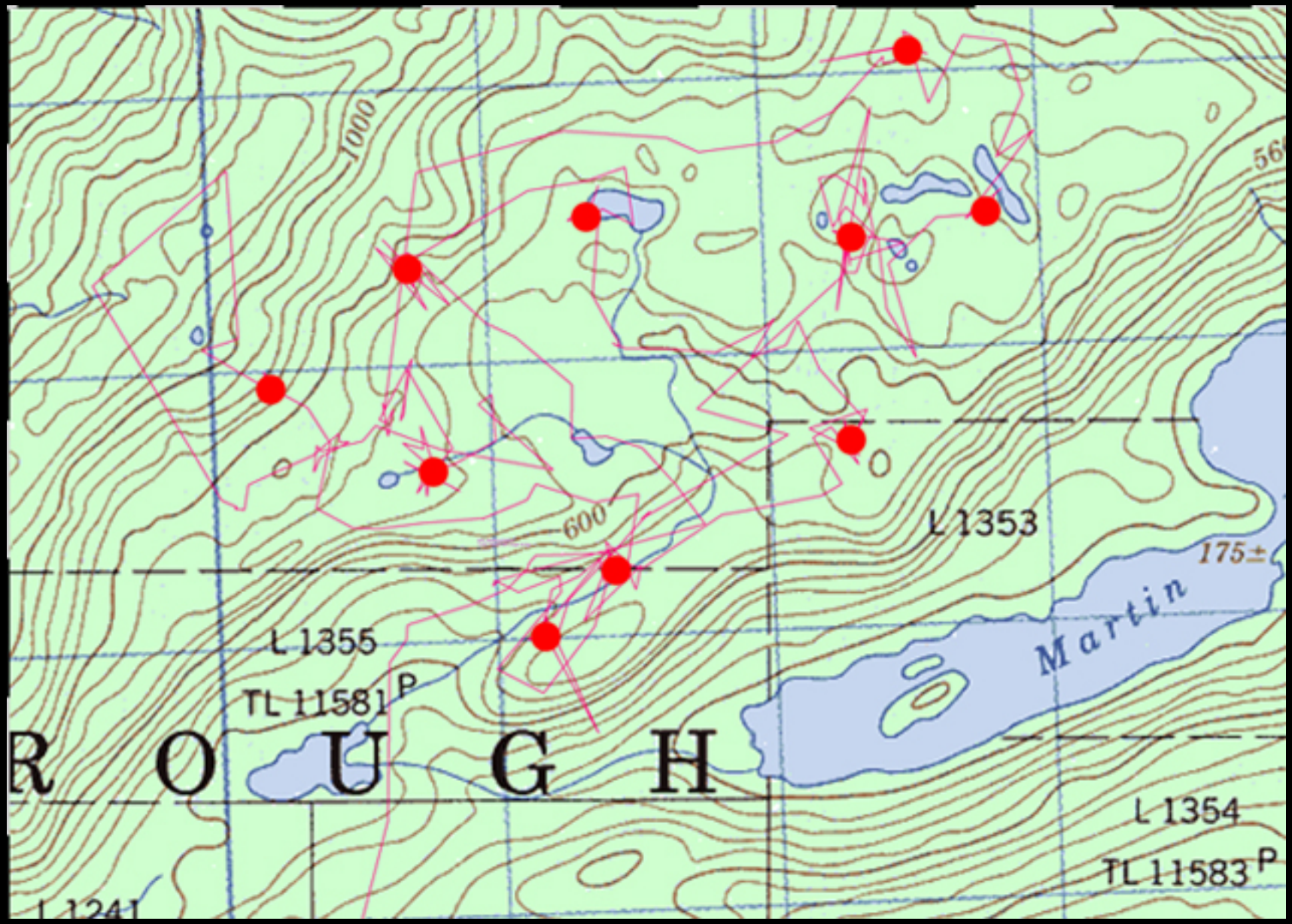
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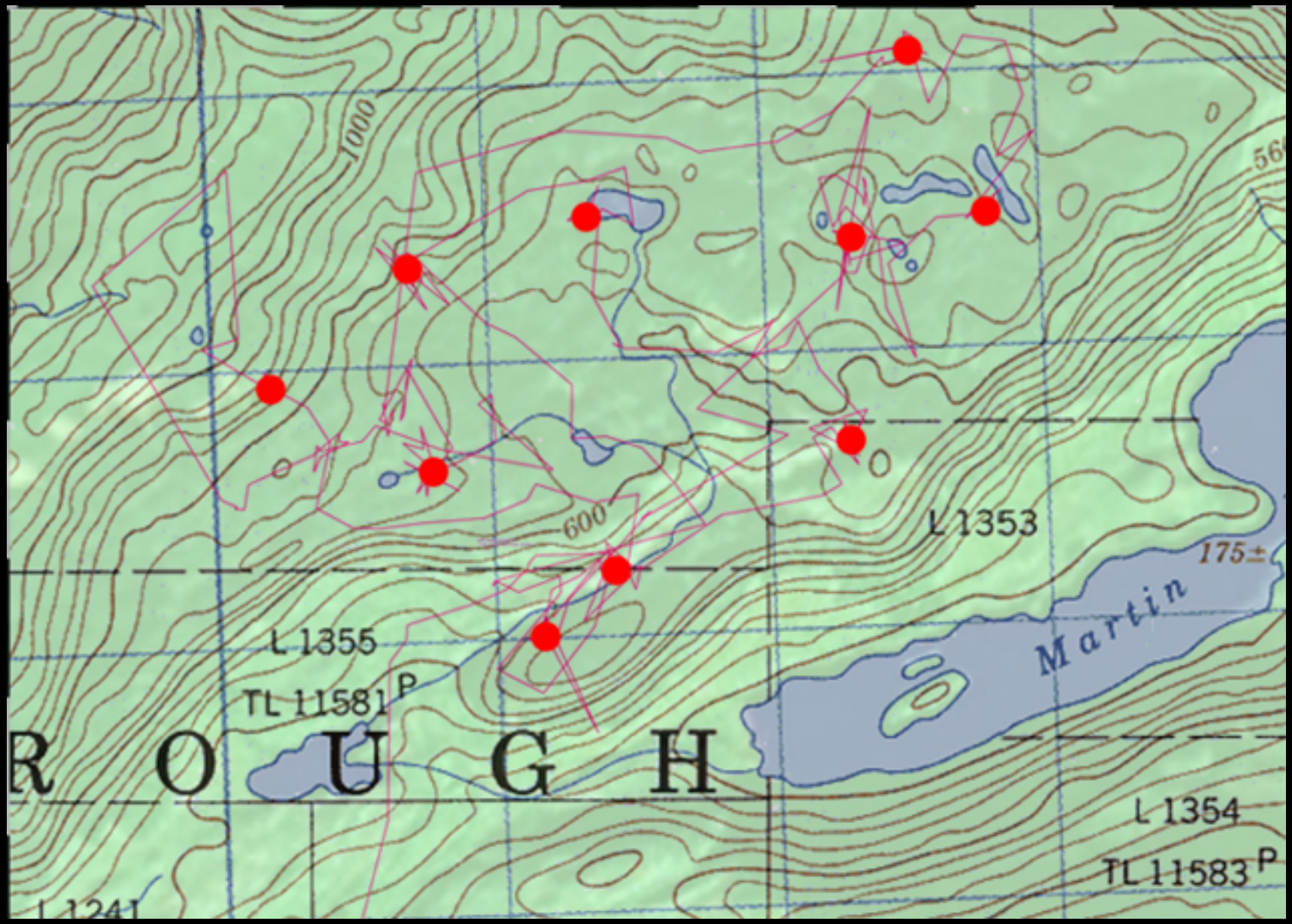
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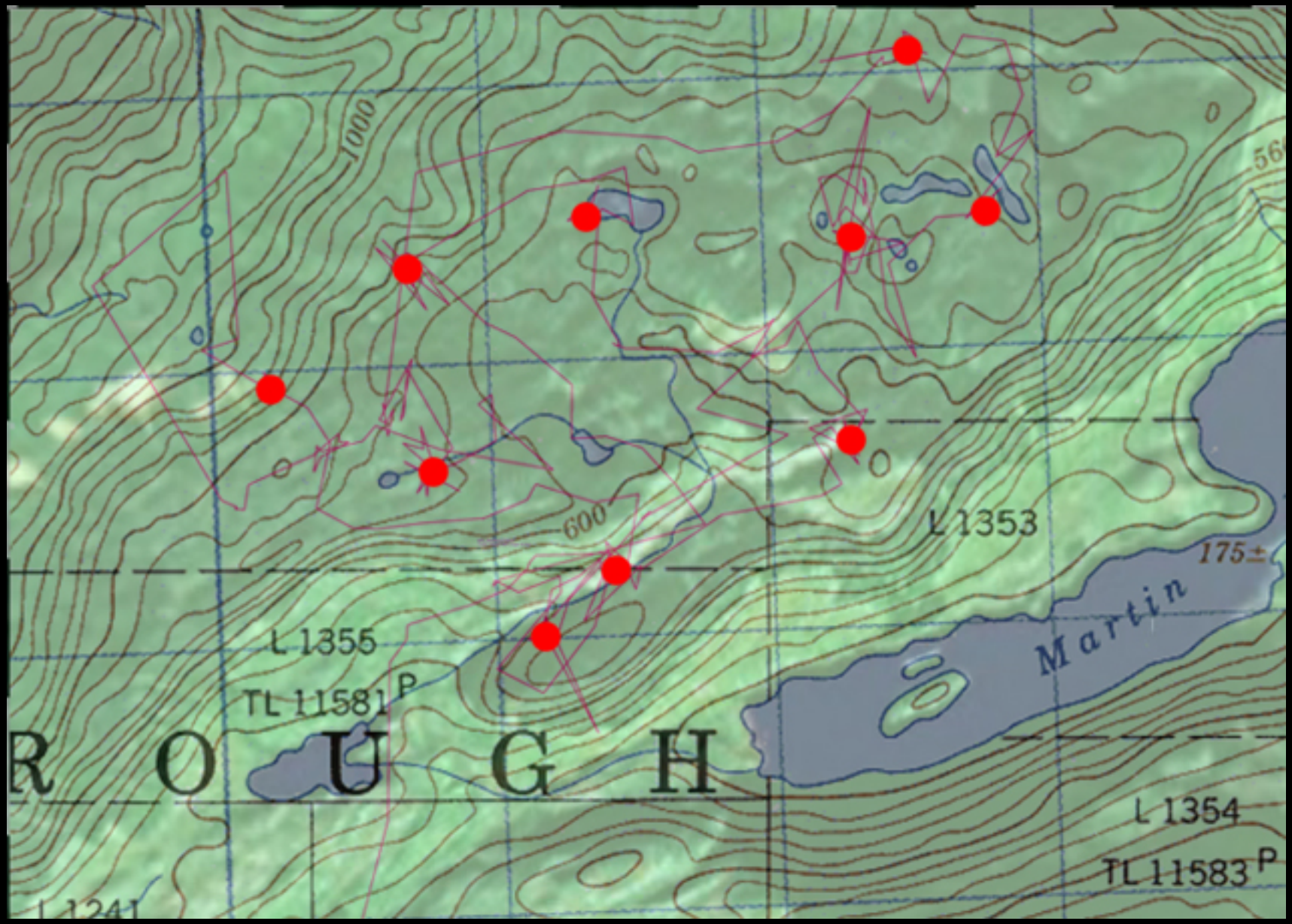
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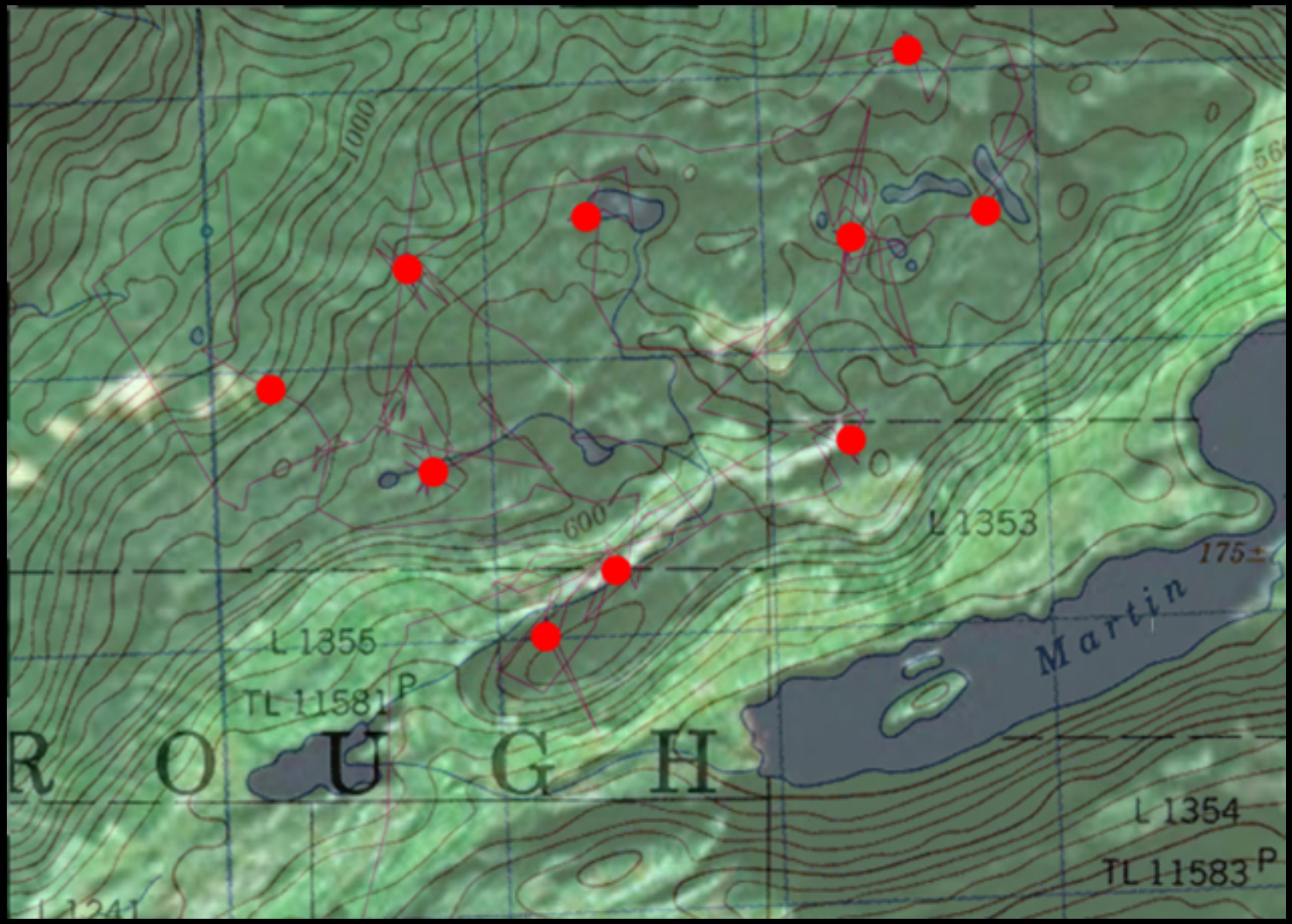
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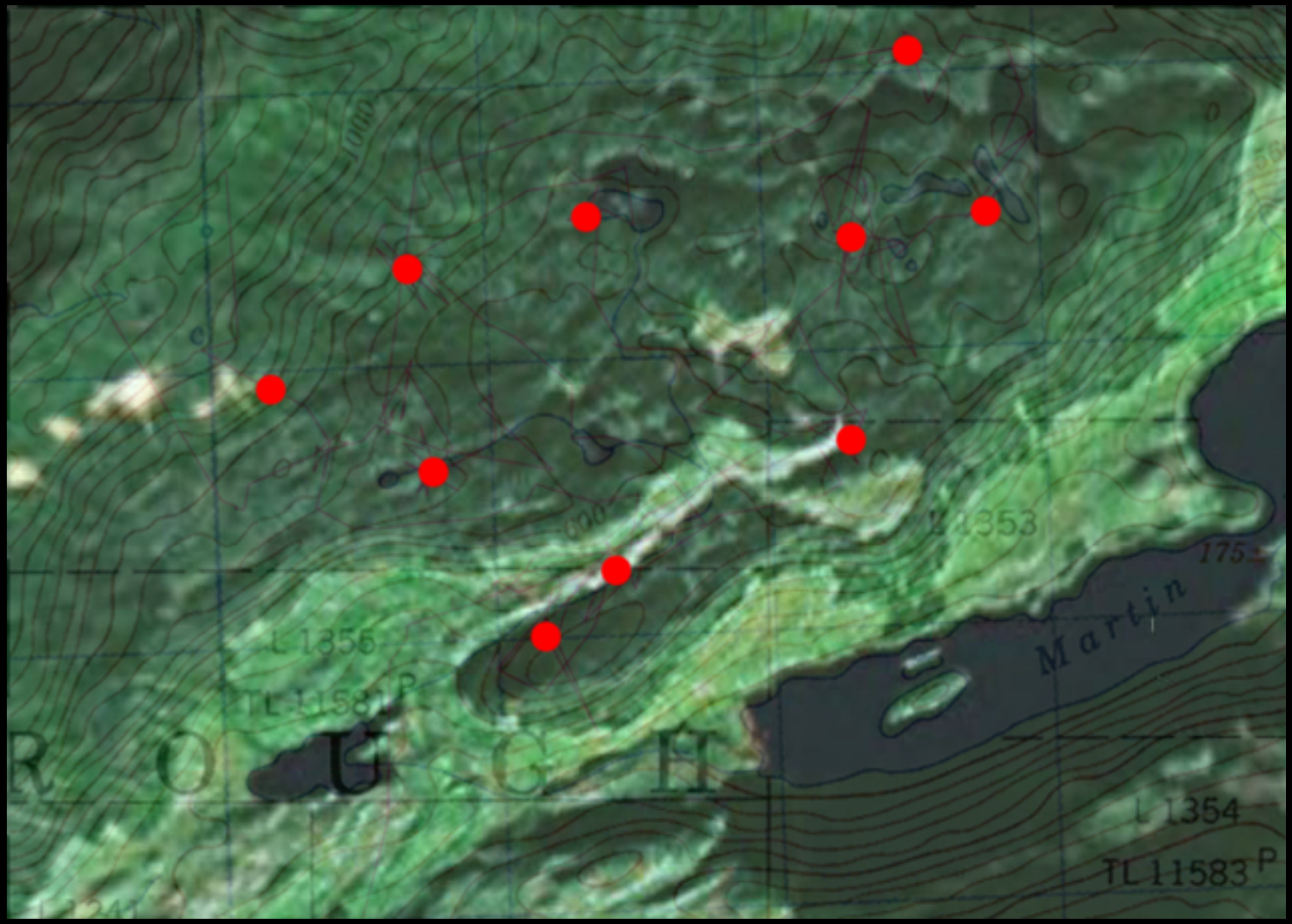
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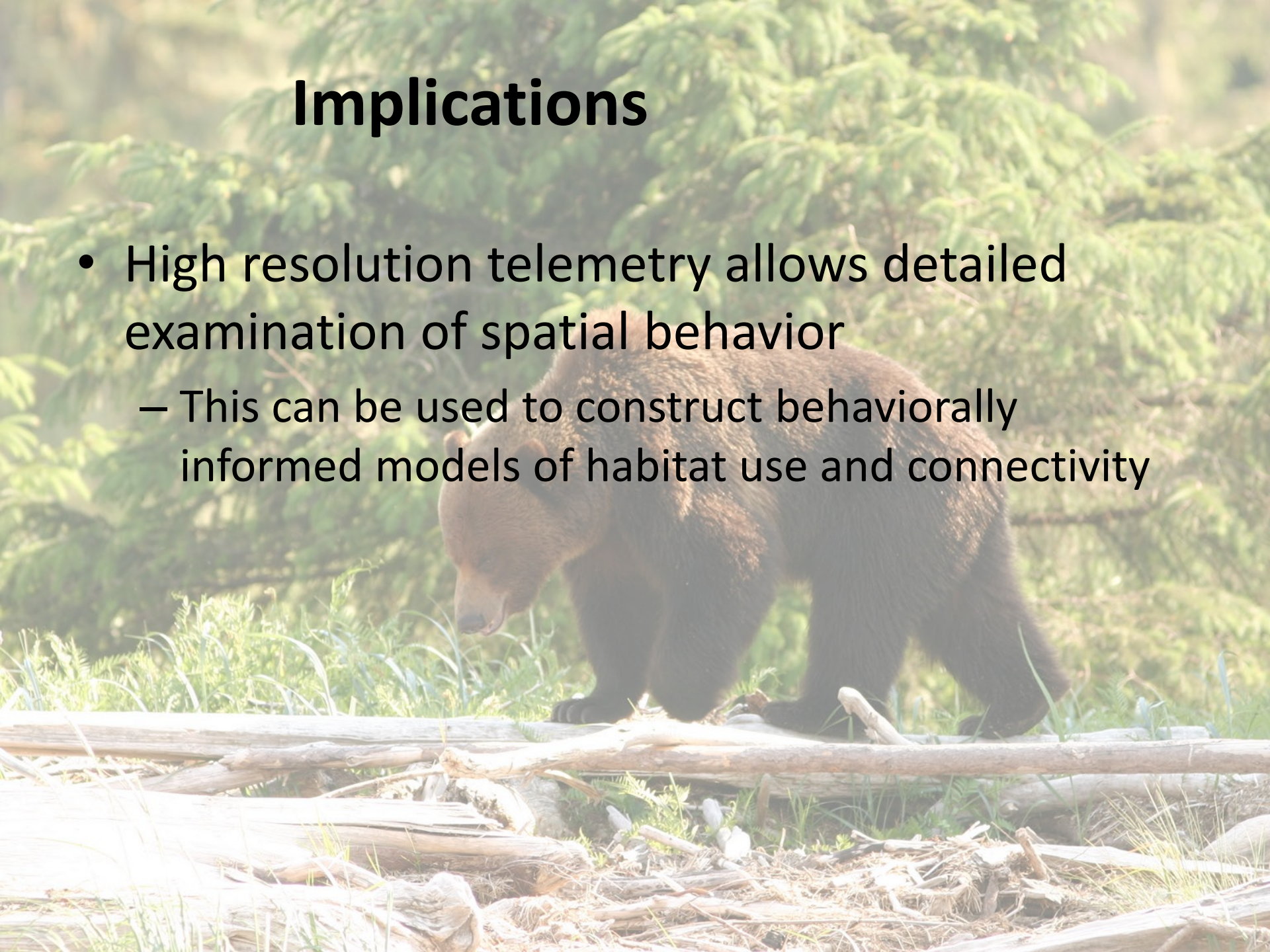
Results

- Summer habitat use
  - Clusters of points indicate foraging sites
  - These occur on edges of mature forest
  - Natural edges (lakes and streams)
  - Man-made edges (boundaries of cut blocks)

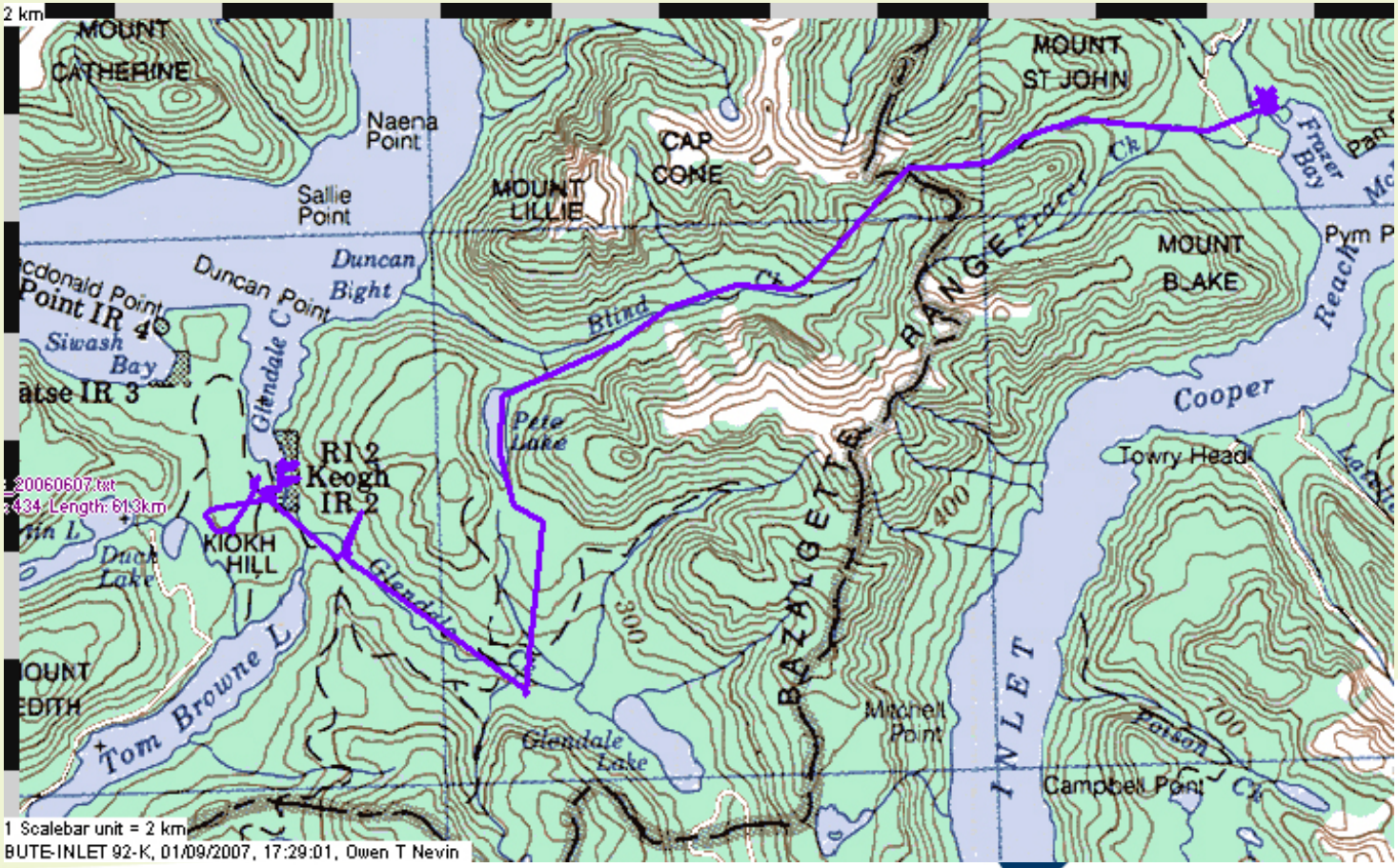


Implications

- High resolution telemetry allows detailed examination of spatial behavior
  - This can be used to construct behaviorally informed models of habitat use and connectivity

Implications

- Trap-lining requires connectivity



BE WHAT YOU WANT TO BE

Grey squirrels – connectivity and invasion

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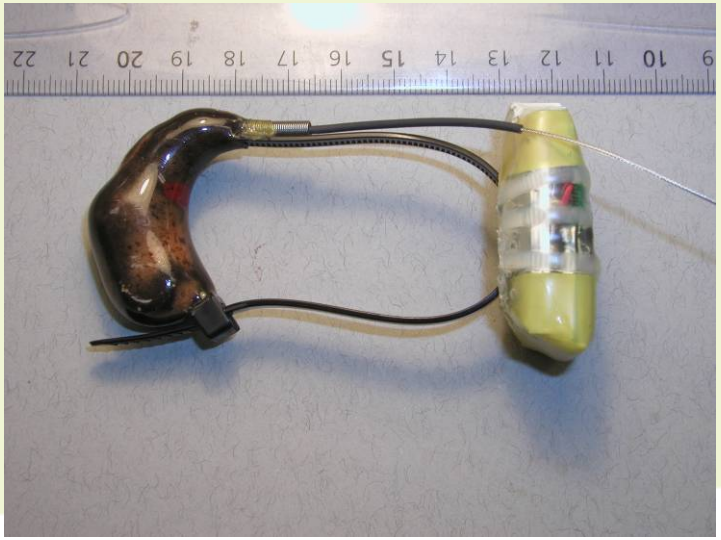
GPS Telemetry - Methodology



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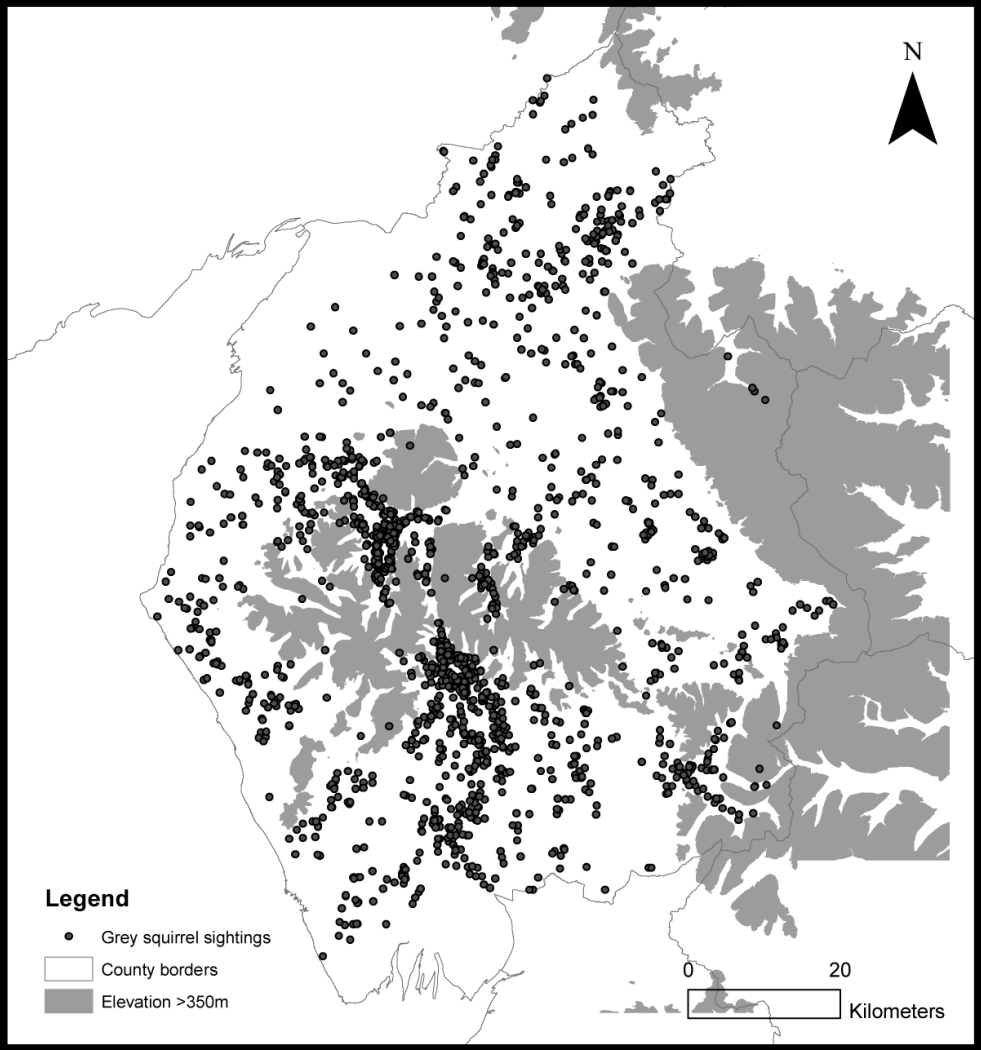
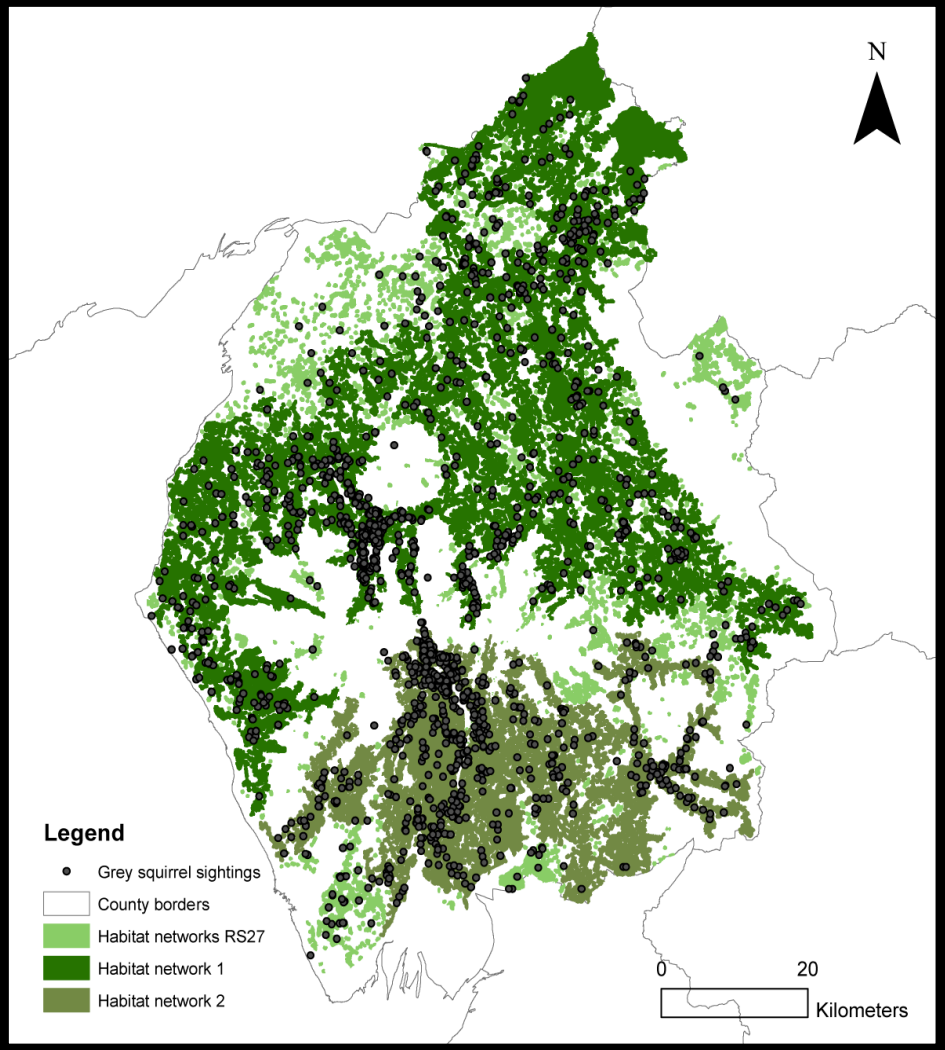
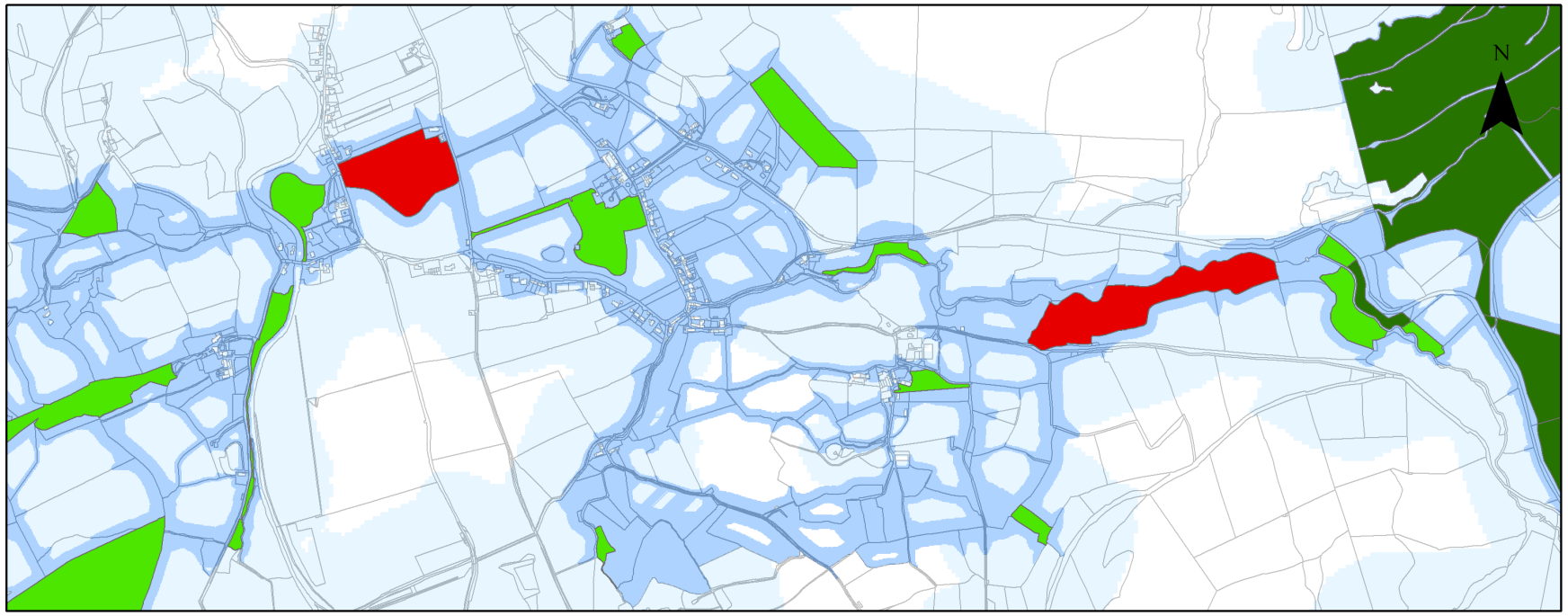
Landscape Ecology Results





Case Study – Whinlatter Forest



Fuzzy logic modelling of snow leopard populations in response to threats from climate change

- **Owen Nevin** [1], Ian Convery [2], Azim Baibagysov [3], Volker Deecke [2], Claire Holt [2], Sabir Nurtazin [3] & Darrell Smith [2]

1. CQUniversity Australia, Gladstone, QLD, Australia
2. University of Cumbria, Ambleside, United Kingdom
3. Kazakh National University, Almaty, Kazakhstan

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Novosibirsk
KAZAKHSTAN
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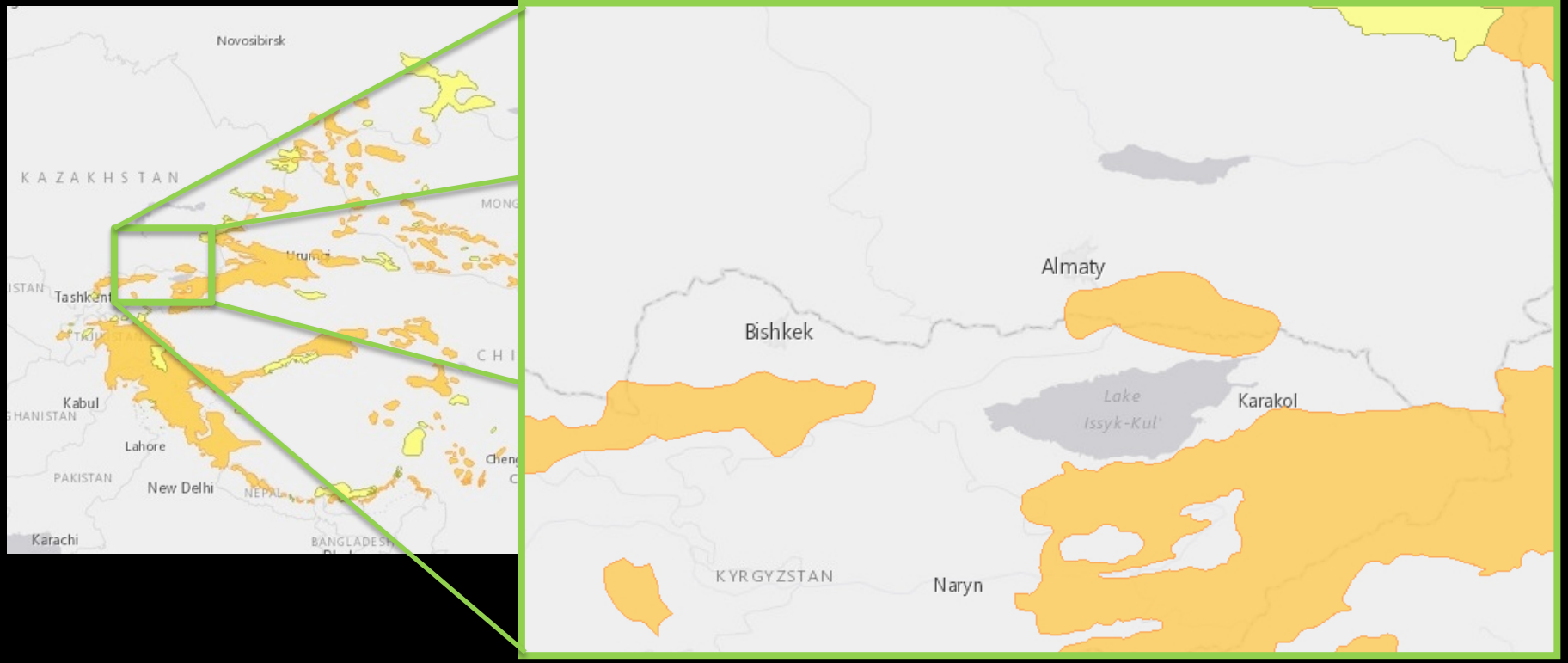
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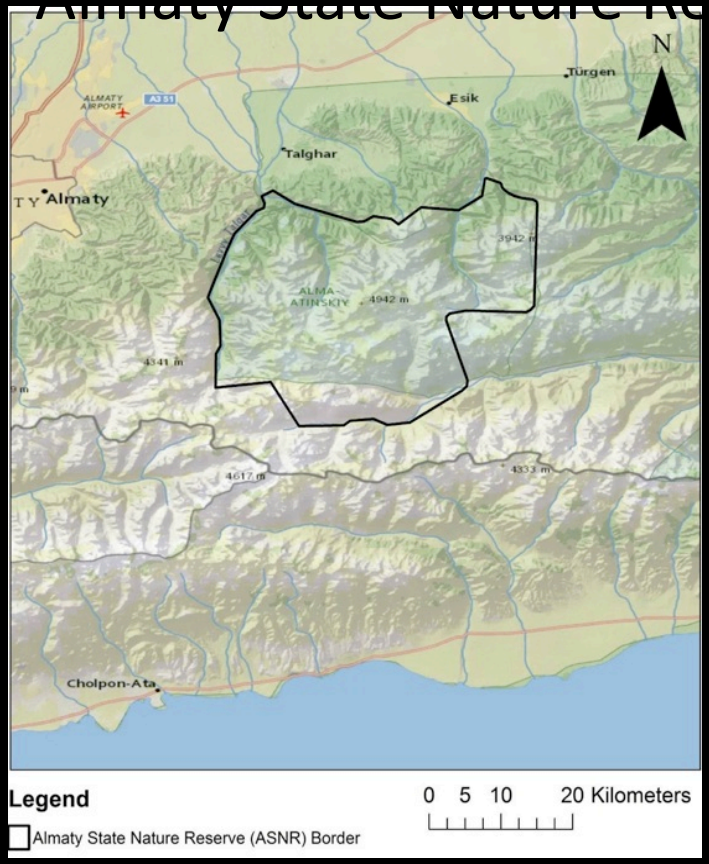


Study site - Almaty State Nature Reserve, Kazakhstan

- ASNR established 1931 - one of the oldest protected areas in the Tian Shan range
- The current area of the reserve is 700km^2
- 950 recorded plant species representative of steppe, wet meadow, forest, and alpine ecosystems
- Fauna includes woodland & alpine mammal species: gray wolf, brown bear, eurasian lynx, siberian ibex, elk, roe deer, grey marmot, and two species of pika. Birds includes golden eagle, lammergeyer, Himalayan snowcock, and chukar.


06/08/2014


03/08/2014

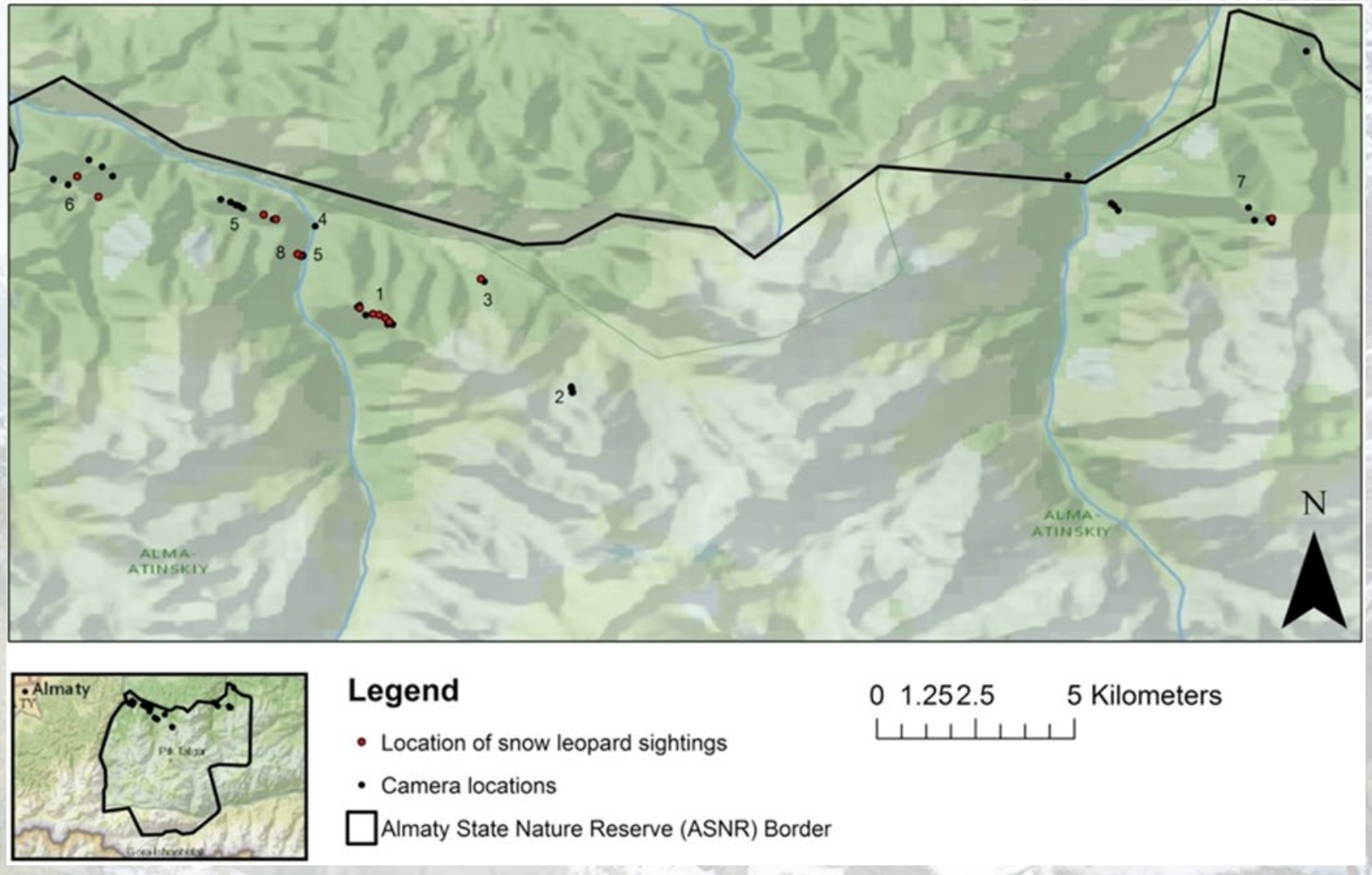

Bushnell
Camera Name
41°F5°C
08-08-2014 07:31:01

Field methods

- 40 x Bushnell Trophy Cam HD deployed Aug 2014 – May 2015
  - Maximum deployment period = 11 months
  - Minimum recorded operational temperature = -22°C
- 5,152 Camera trap nights
- Sample area 25 * 10 km
- Elevationally-stratified saturation sampling approach

- Also conducted:
  - ungulate prey abundance surveys
  - standard sign survey techniques (based on the Snow Leopard Information Management System) approach developed by Jackson & Hunter (1996)

Field methods



Camera Trapping Results

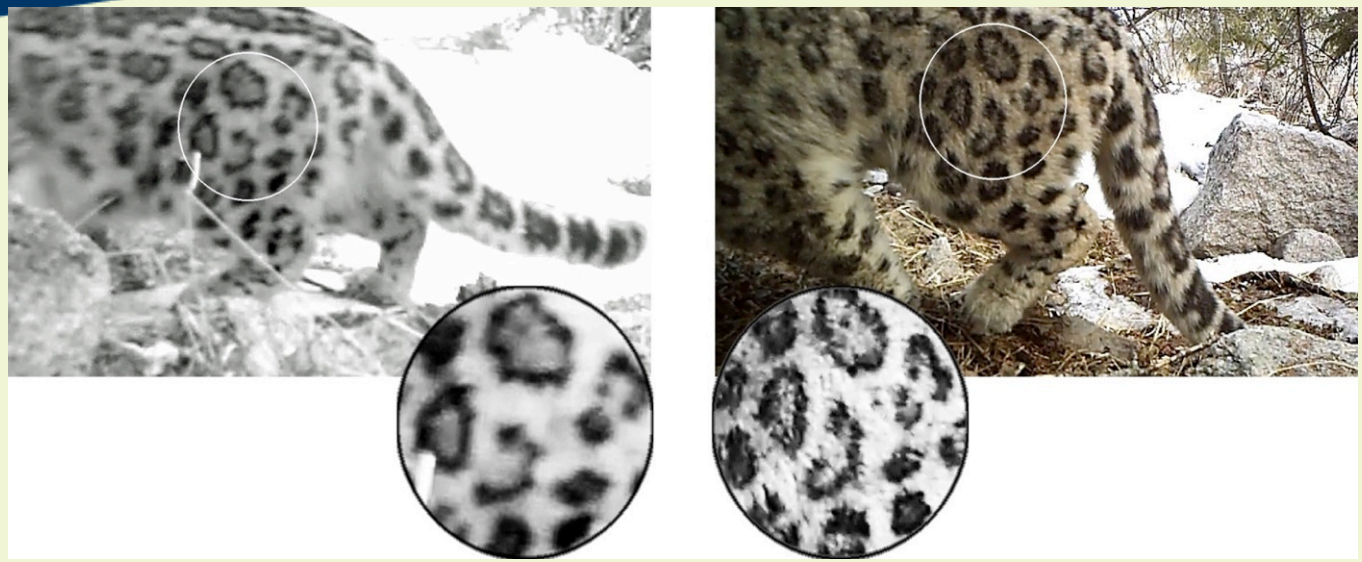
- 50 independent capture events of snow leopards
  - between 1 and 10 images per event
- Catch Per Unit Effort (CPUE) = 0.97 per 100 trap nights
  - High for snow leopard studies
- 275 capture events of primary prey
- 68 capture events of secondary prey.

Individual identification

- We tested a number of population estimation techniques:
  - individual identification through local knowledge
  - expert knowledge
  - 3-D pattern recognition software (ExtractCompare; conservationresearch.co.uk 2013)
  - 2-D pattern recognition software (Wild-ID; Bolgeret al., 2011).
  - For comparison/baseline also used photographs of 4 captive individuals (Lakeland Wildlife Oasis, UK)

Individual identification

- For individual identification by experts we followed the methodology of Jackson et al. (2006)
- All photographs were classified according to the aspect of the animal (face, left and right flank, and tail).
- Photographic quality was subjectively scored on a scale from: 0 – 5:
  - 0 (no useful information)
  - 5 (clear full-frame side-on image with good contrast)



Camera trap images of the same individual snow leopard. The left picture was taken at 08:12hrs local time on 28 Feb. 2015 using the camera's infrared flash, the right picture was captured by the same camera trap at 16:45hrs on 07 Mar. 2015 using natural light. Insets show the pelage patterns used for identification.

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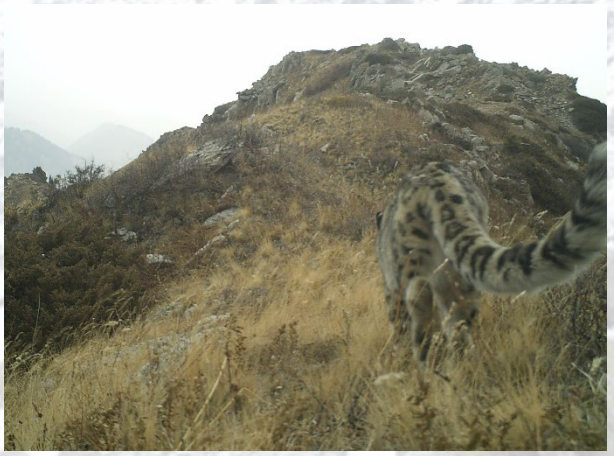
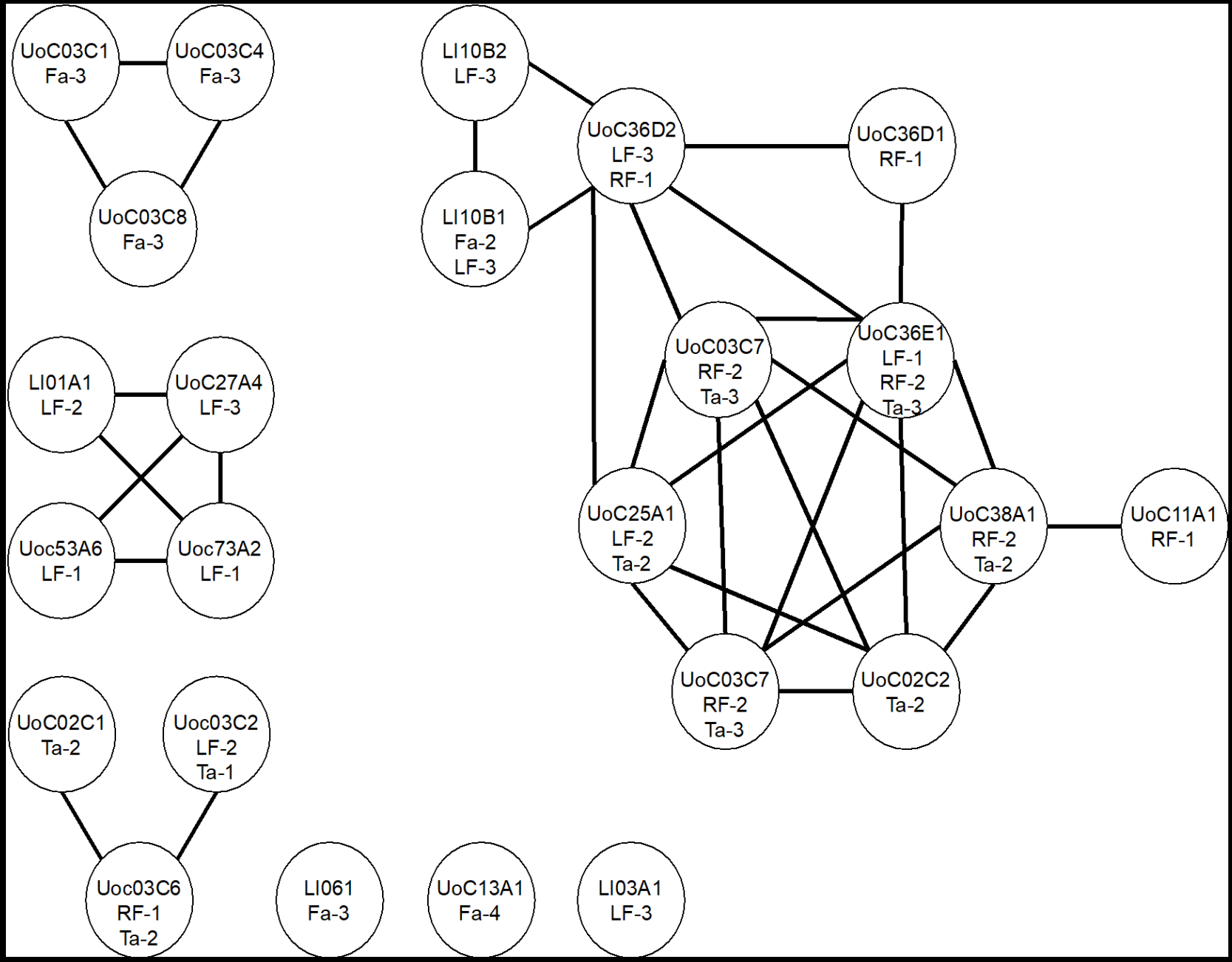
Individual identification

- 50 detections events = 39 matching events
- Large number (10) capture events = 1 individual
- The largest number of unique individuals was given by the analysis of flank shots

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UoC03C4
Fa-3
UoC03C8
Fa-3
LI10B2
LF-3
UoC36D2
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RF-1
UoC36D1
RF-1
LI10B1
Fa-2
LF-3
UoC03C7
RF-2
Ta-3
UoC36E1
LF-1
RF-2
Ta-3
LI01A1
LF-2
UoC27A4
LF-3
UoC25A1
LF-2
Ta-2
UoC38A1
RF-2
Ta-2
UoC11A1
RF-1
Uoc53A6
LF-1
Uoc73A2
LF-1
UoC03C7
RF-2
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Ta-2
Uoc03C2
LF-2
Ta-1
Uoc03C6
RF-1
Ta-2
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Fa-3
UoC13A1
Fa-4
LI03A1
LF-3

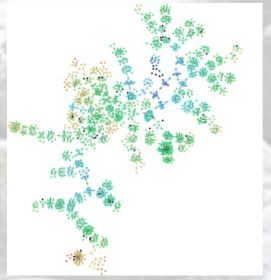
Population estimation

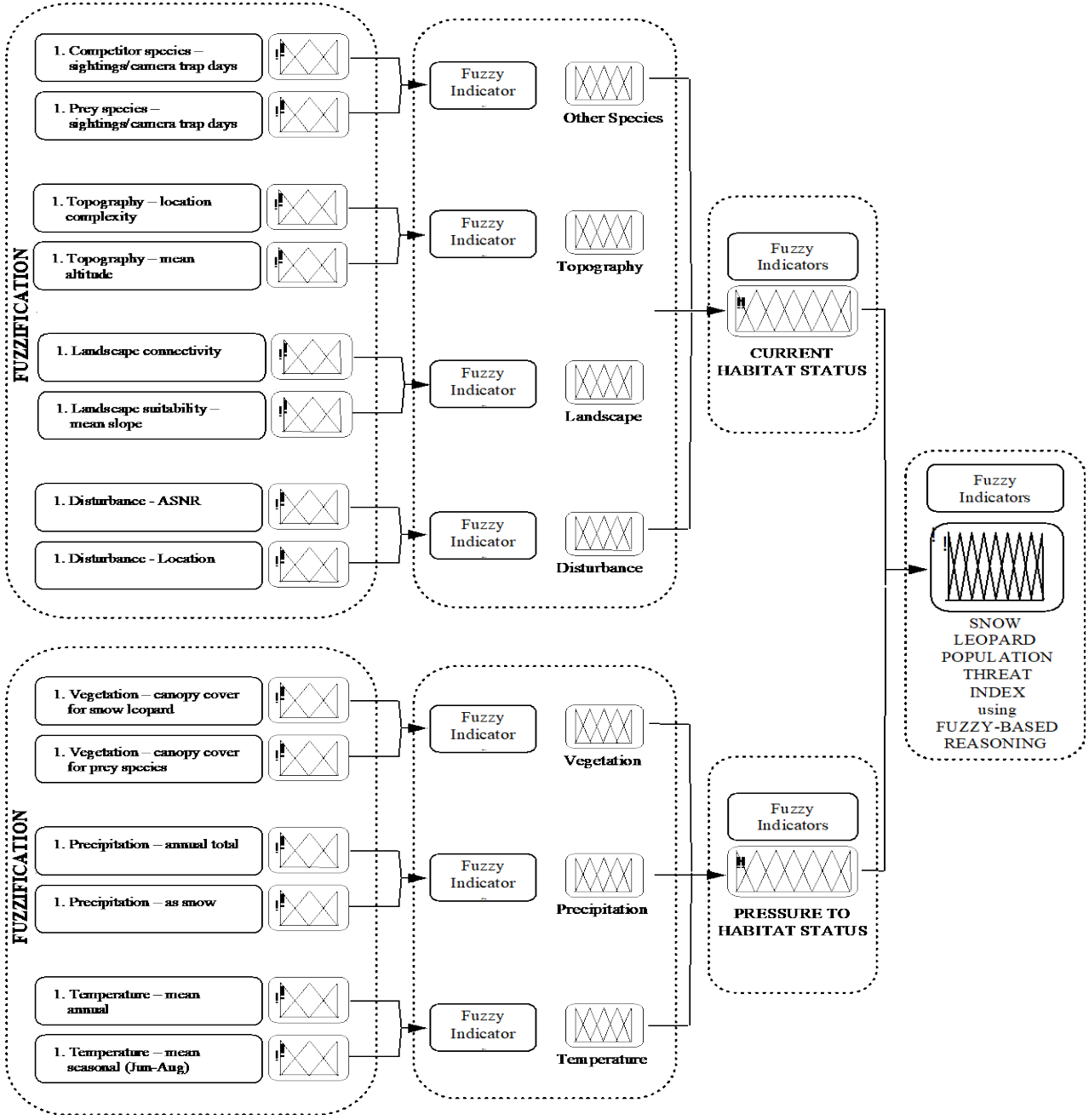
- Capture histories of identified individuals used in a capture-mark-recapture analysis using Cormack-Jolly-Seber population estimate
  - 11 individuals (with 95% CI 11 – 18)
- Estimated population density 4.4 –7.2 SLs/100km^2
- Comparable density elsewhere in range; e.g. Hemis National Park, Ladakh, India (Jackson et al., 2006)

Fuzzy logic modeling

- Fuzzy logic uses quantitative and qualitative data - data aggregated into composite indicators, expresses difficult to define terms such as sustainability (Kouloumpis et al., 2008).
- The fuzzy snow leopard model was run on ‘if-then’ rules to produce a composite estimate of the snow leopard environment across a variety of locations.



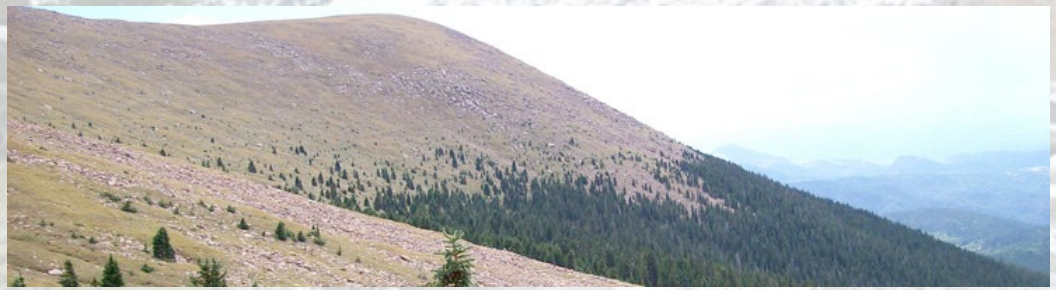



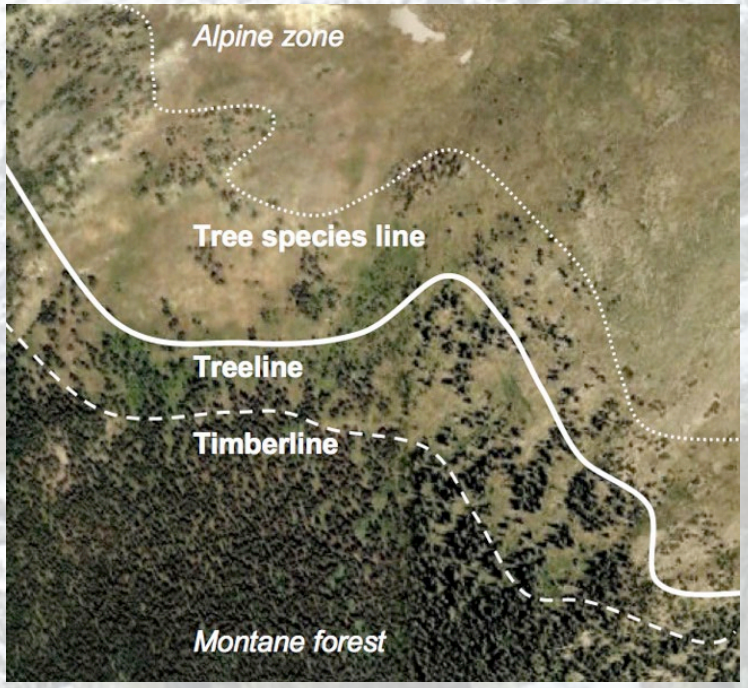



Schematic of the hierarchical fuzzy model for snow leopard environmental evaluation across a range locations in ASNR.

Fuzzy logic modeling

- Three IPCC climate change scenarios considered:
  - scenario B1 +1.8^{0}C
  - scenario A1B +2.8^{0}C
  - scenario A2 +3.4^{0}C
- Also used by Forrest et al. (2012) in their assessment of snow leopard habitat vulnerability to treeline shift in the Himalayas

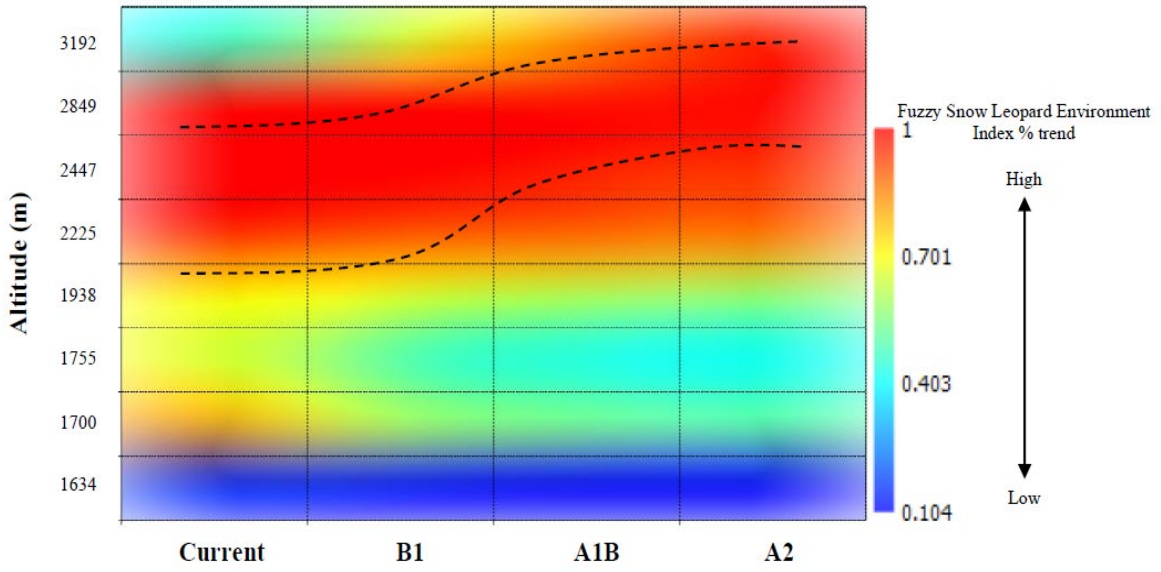




Fuzzy logic modeling

- Current habitat status:
  - Prime habitat 2000 – 3000 m.
  - Areas **above** and **below** this band are less favorable
  - lowest suitability below 1600m

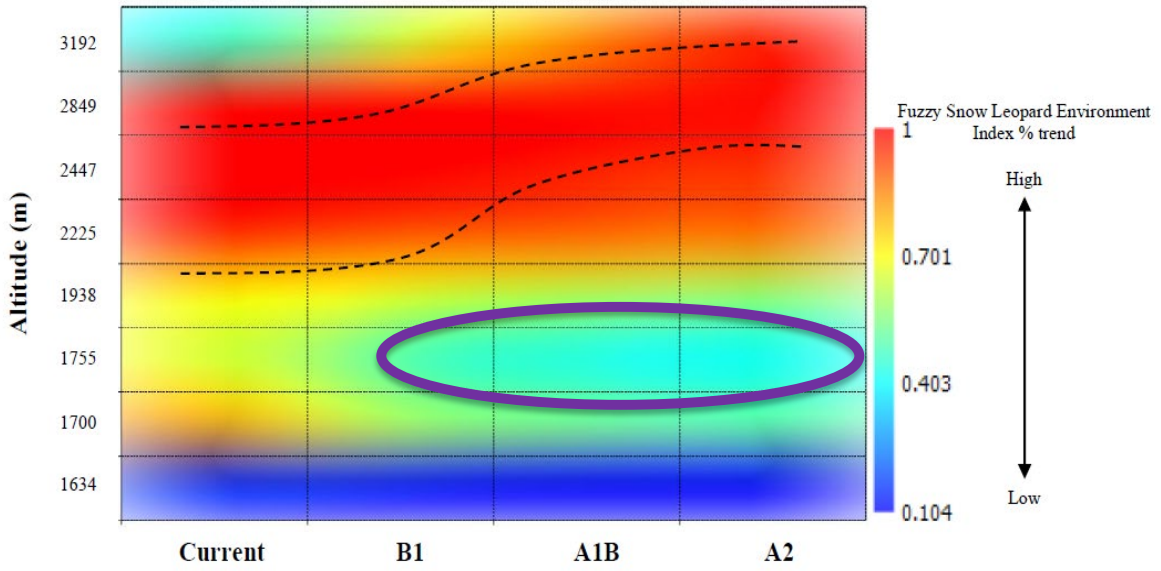
- Model describes a general pattern of decreasing habitat suitability (58%) in response to climate change
  - reduction in snow leopard habitat suitability in ASNR
  - some areas will have the potential to become suitable (above 3000m)



Matrix plot of modelled snow leopard environmental index; constriction of red banding illustrates the pressure due to increased temperature on high value snow leopard habitat.

Fuzzy logic modeling

- Competition?
  - increased completion from other predators
  - Especially species better adapted to forest habitats
  - Likely more intense in winter
    - Prey switching from ibex to forest ungulates
    - Direct competition with wolf and Eurasian lynx
- Also likely throughout range:
  - as forests move upslope - colonization by other species, including common leopards (*Panthera pardus*), wild dogs (*Cuon alpinus*), and in Bhutan, tigers (*Panthera tigris*)



Matrix plot of modelled snow leopard environmental index; constriction of red banding illustrates the pressure due to increased temperature on high value snow leopard habitat.

Management implications

- With climate warming, habitat at lower elevations become unsuitable at a faster rate than habitat in higher elevations becomes available
- Strongest negative impacts below treeline
- Pinching effect - overall availability of suitable snow leopard habitat will be reduced
- Connectivity across valley bottoms & using densely forested habitat in winter (prey switching) impacted with small changes

Back to bears!

Grizzly Bear Habitat Management In Canada's Rocky Mountain Parks: Balancing Visitor Expectations With Bear Habitat Requirements

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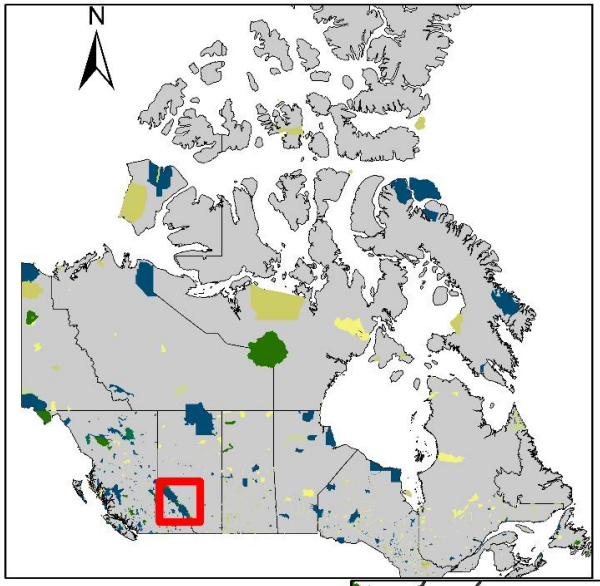
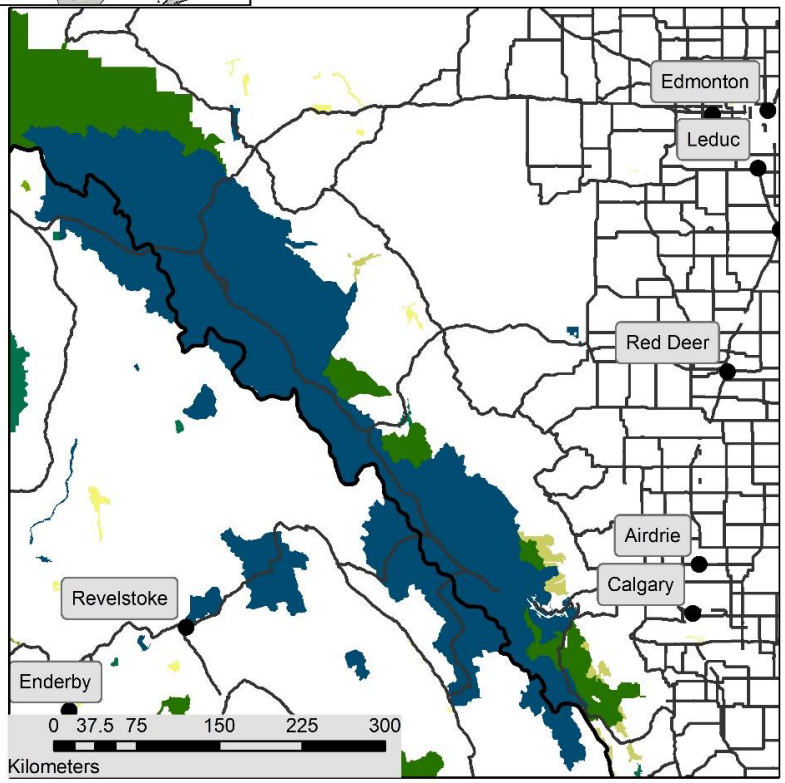


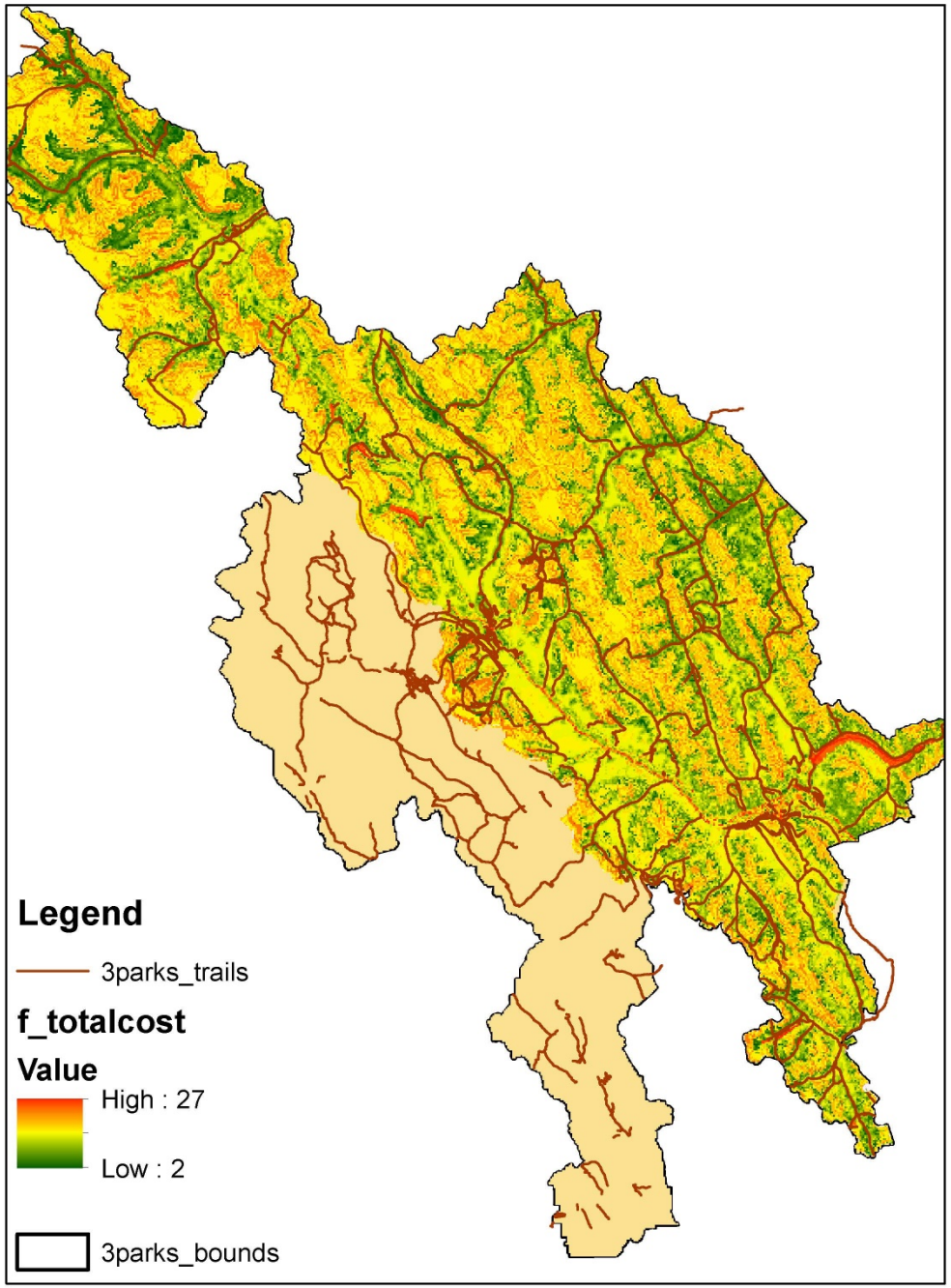
Legend

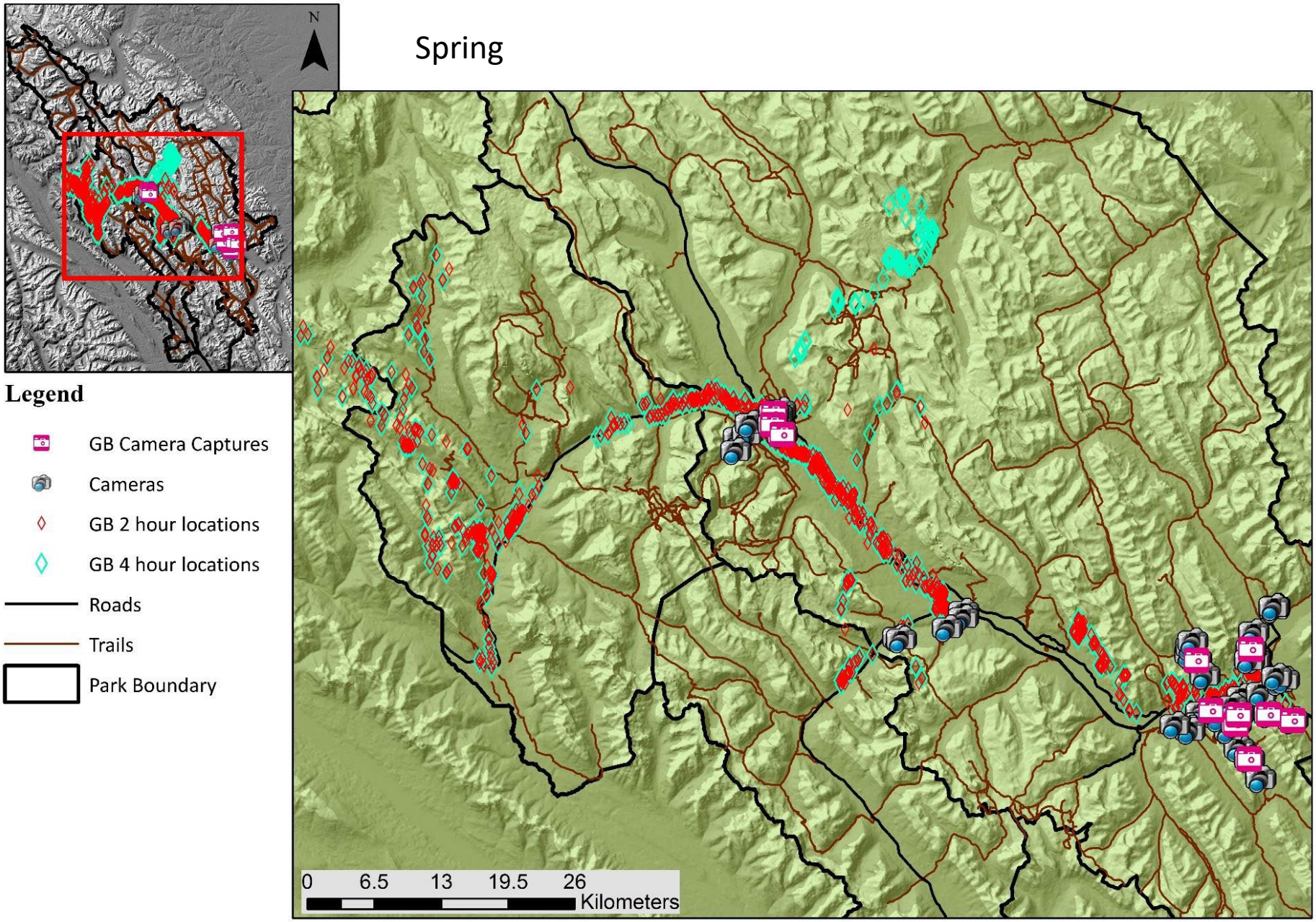
- Canada Provincial Boundaries
- Canada Major Cities
- Highway or Major Road
- Strict Nature Reserve
- Wilderness Area
- National Park
- Natural Monument
- Habitat/Species Management Area
- Protected Landscape/Seascape
- Managed Resource Protected Area
- Unknown

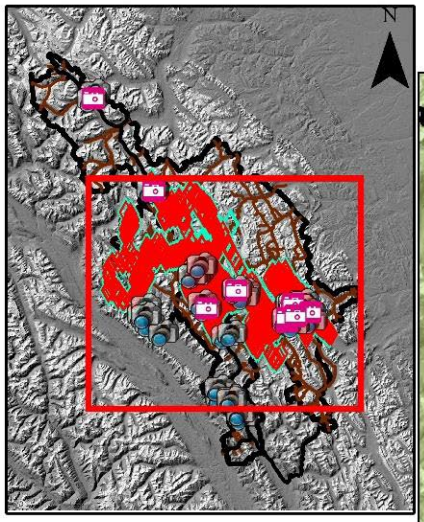
20,238 km^2
40,000 residents
5.5M visitors

423 camera trap sites
23 GPS collared bears

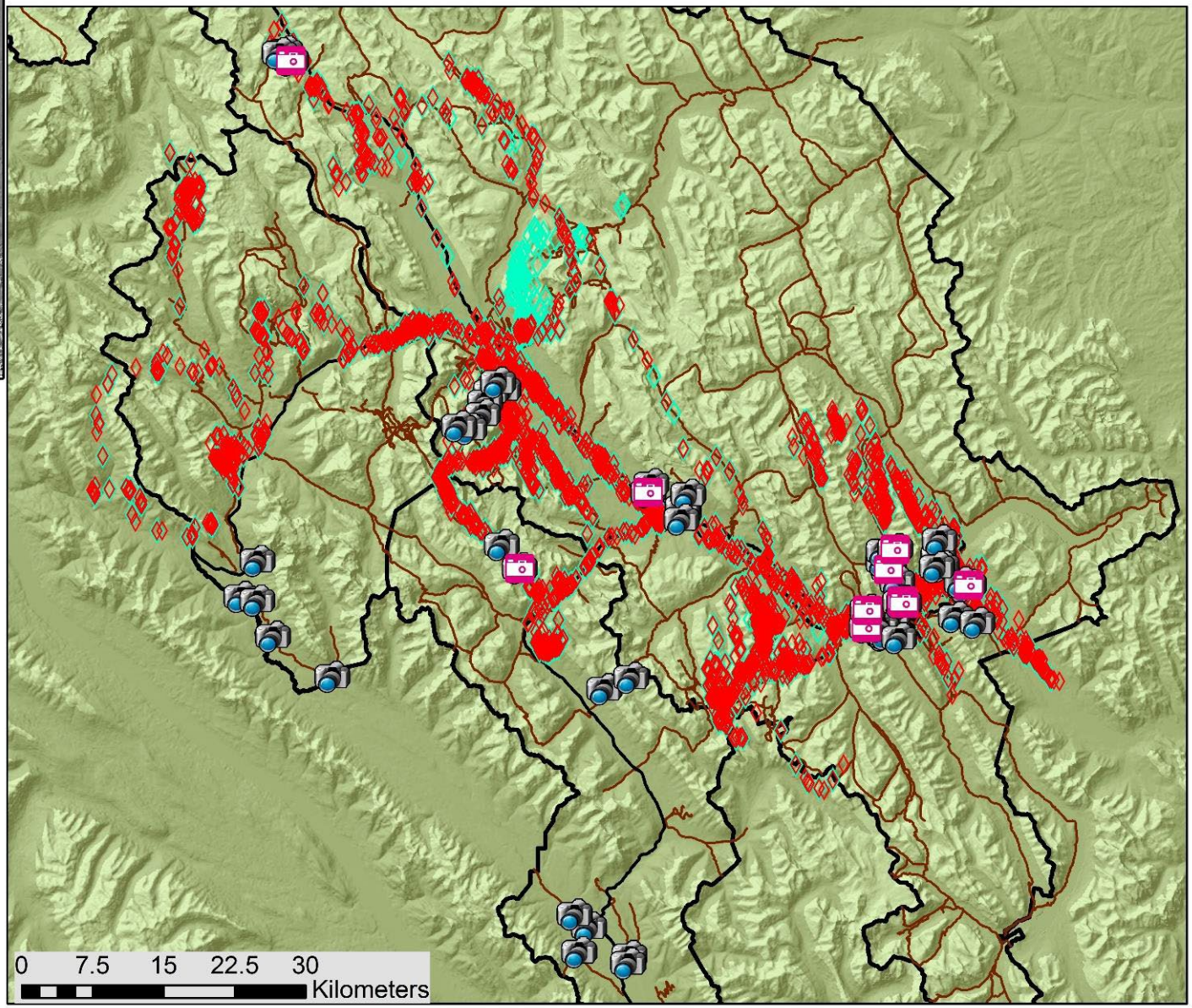



Legend
3parks_trails
f_totalcost
Value
High : 27
Low : 2
3parks_bounds


N
Spring
Legend
GB Camera Captures
Cameras
GB 2 hour locations
GB 4 hour locations
Roads
Trails
Park Boundary
0 6.5 13 19.5 26
Kilometers

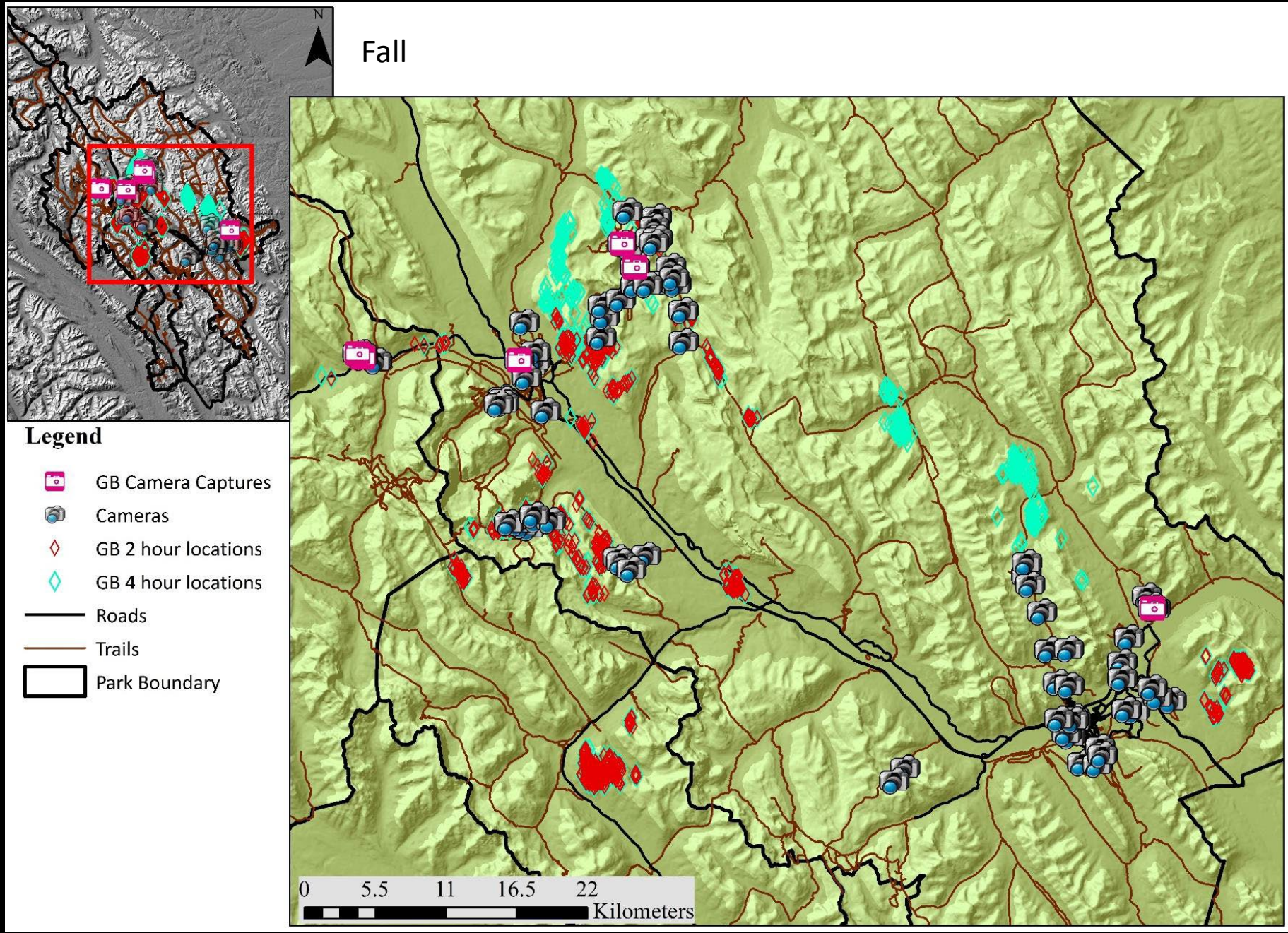


Summer



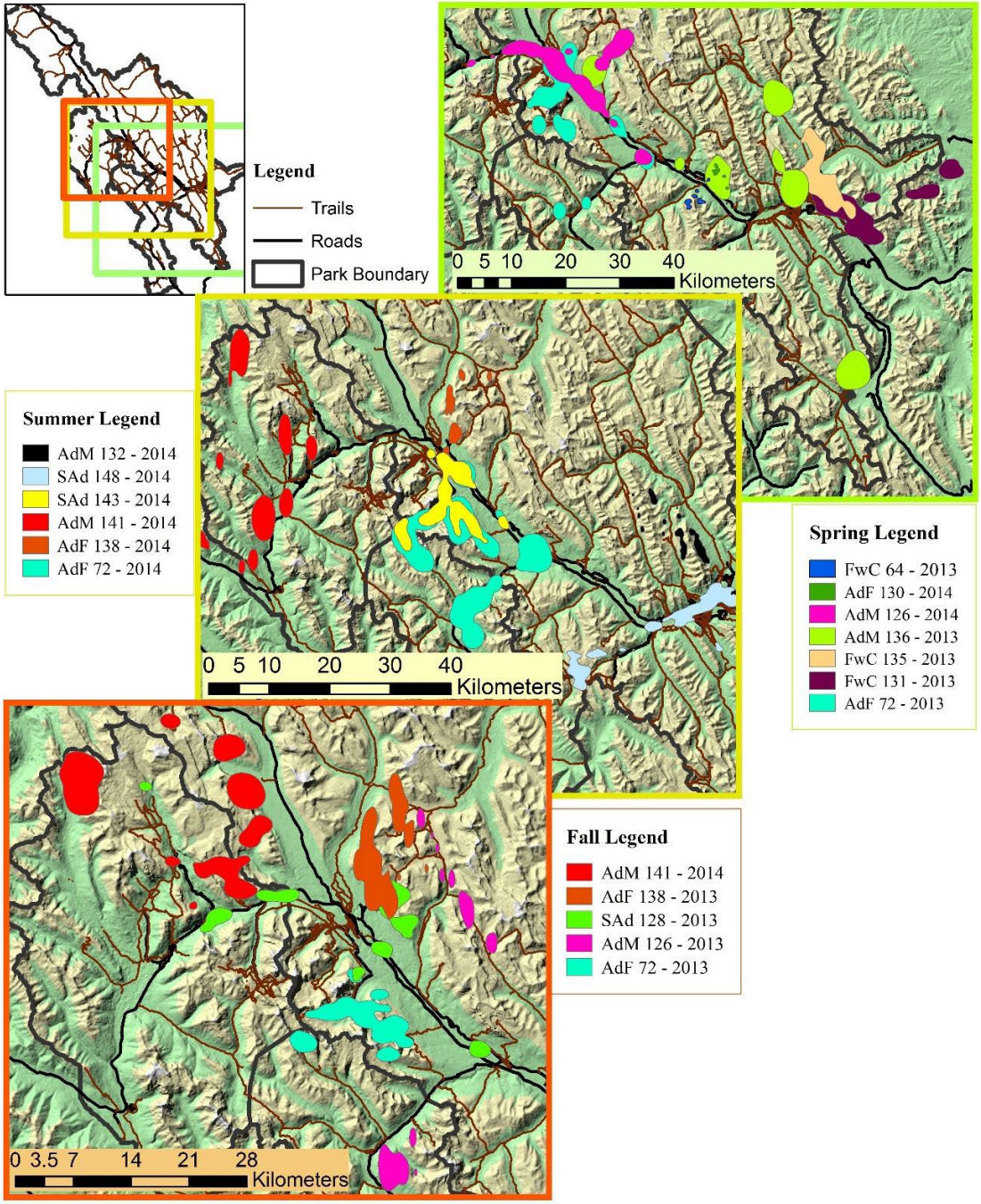
Legend

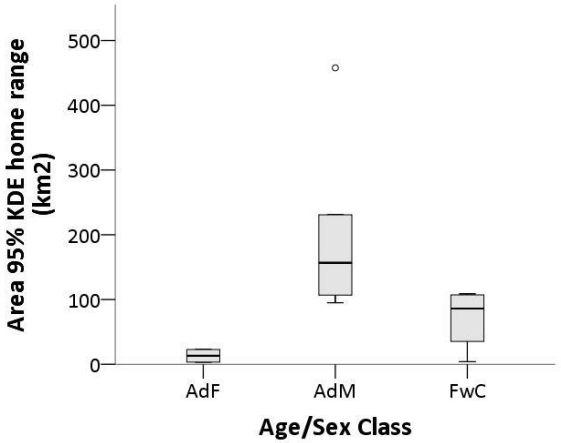
- Grizzly Bear Captures
- Cam Locations Su14
- GB 2 hour locations
- GB 4 hour locations
- Roads
- Trails
- Park Boundary

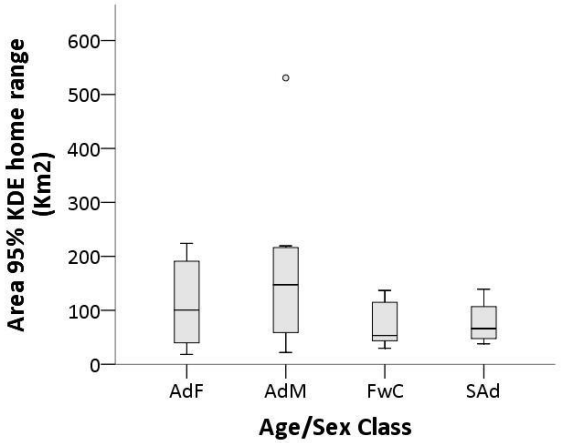

Fall
N
Legend
GB Camera Captures
Cameras
GB 2 hour locations
GB 4 hour locations
Roads
Trails
Park Boundary
0
5.5
11
16.5
22
Kilometers

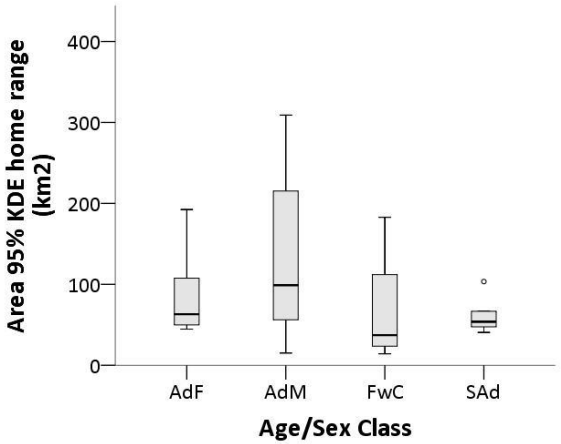

Bushnell
KL1 70°F21°C
07-23-2012 19:45:18


Bushnell
SK8 46°F7°C
01-08-2013 11:45:57


Legend
Trails
Roads
Park Boundary
0 5 10 20 30 40
Kilometers
Summer Legend
AdM 132 - 2014
SAd 148 - 2014
SAd 143 - 2014
AdM 141 - 2014
AdF 138 - 2014
AdF 72 - 2014
Spring Legend
FwC 64 - 2013
AdF 130 - 2014
AdM 126 - 2014
AdM 136 - 2013
FwC 135 - 2013
FwC 131 - 2013
AdF 72 - 2013
Fall Legend
AdM 141 - 2014
AdF 138 - 2013
SAd 128 - 2013
AdM 126 - 2013
AdF 72 - 2013
0 3.5 7 14 21 28
Kilometers

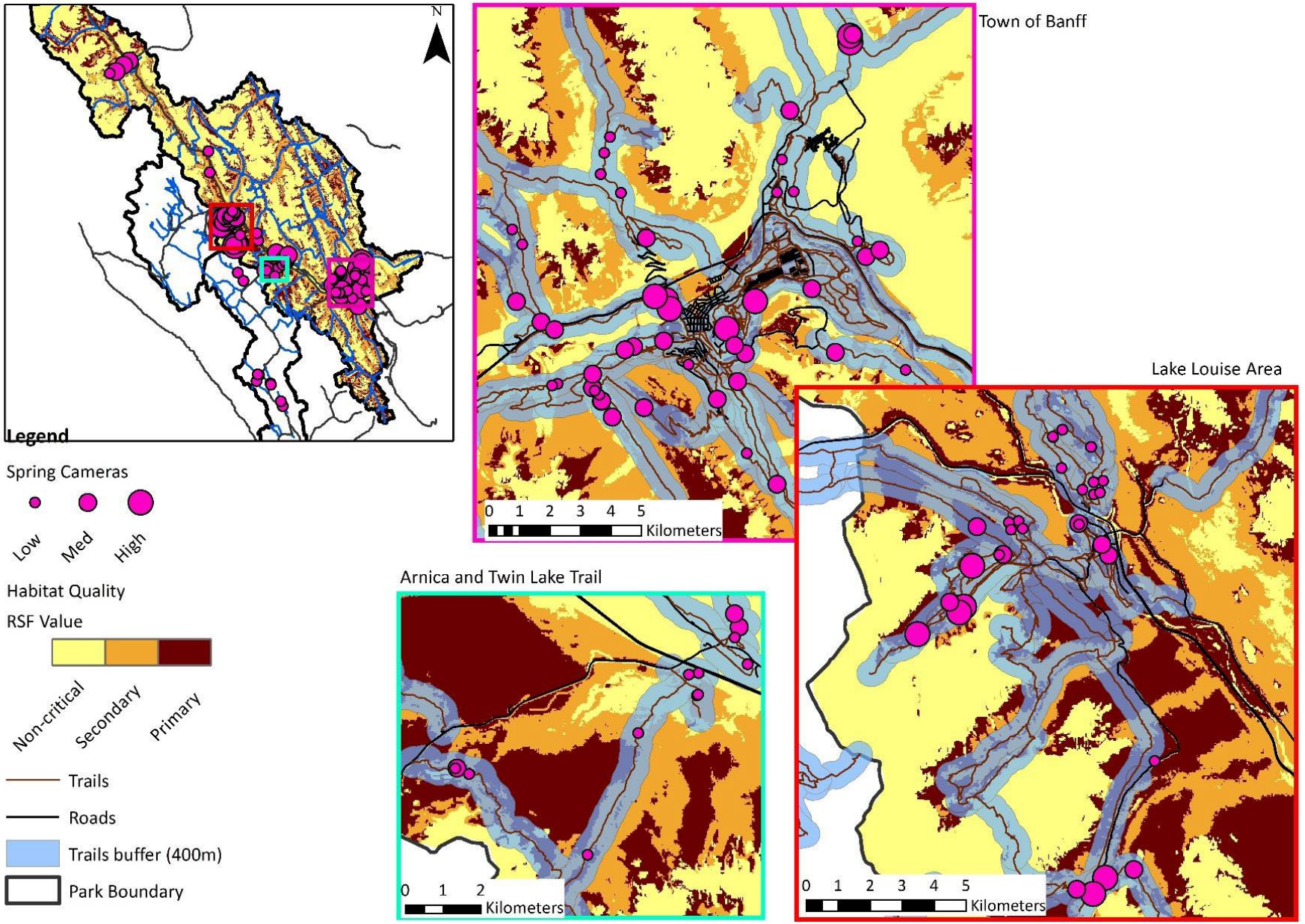

Area 95% KDE home range (km2)
500
400
300
200
100
0
AdF
AdM
FwC
Age/Sex Class

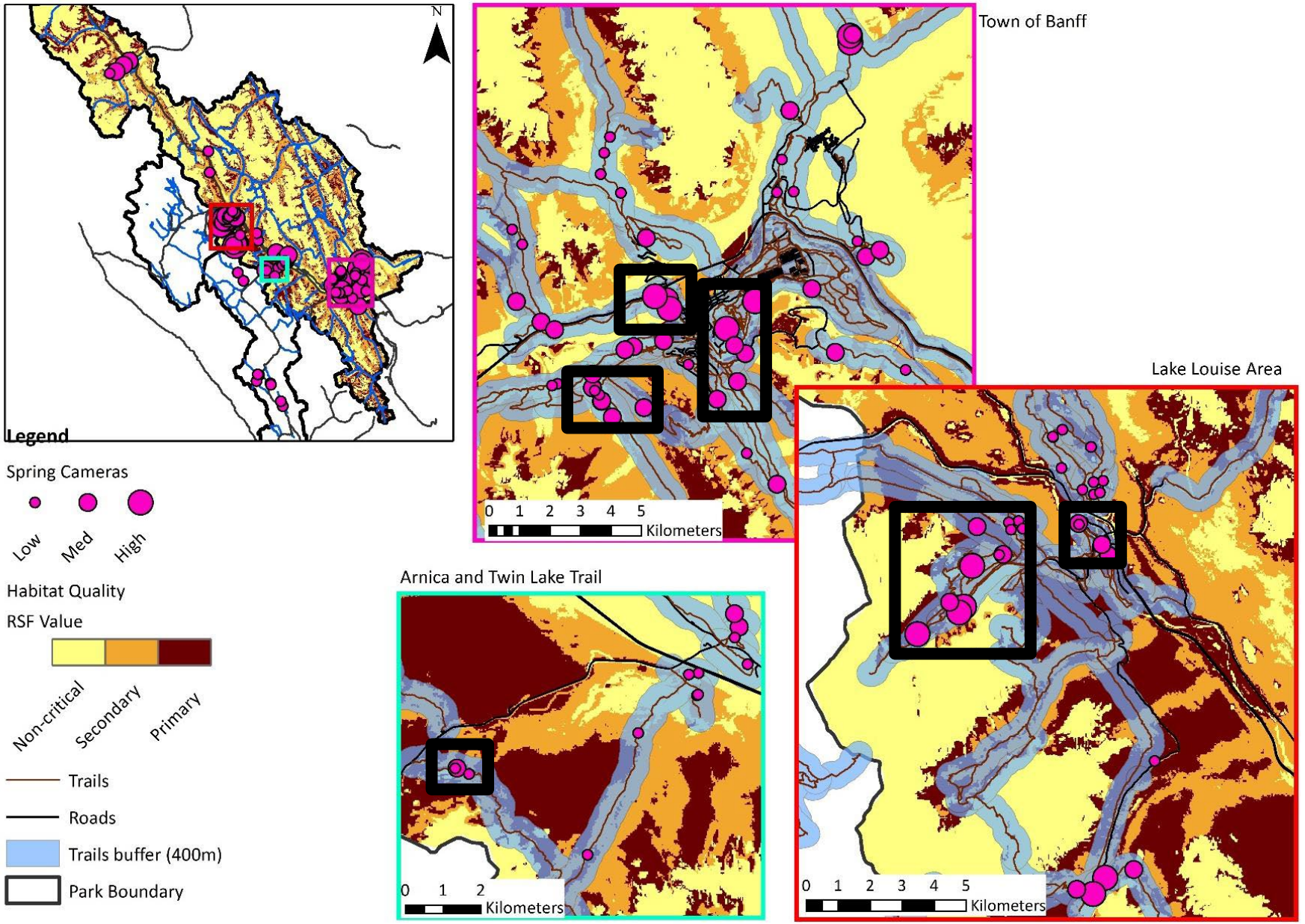

Area 95% KDE home range (Km2)
600
500
400
300
200
100
0
AdF
AdM
FwC
SAd
Age/Sex Class


Area 95% KDE home range (km2)
400
300
200
100
0
AdF
AdM
FwC
SAd
Age/Sex Class

Results

- Bear use of human trails was highest in Spring and lowest in Fall
- Bears select for high quality habitat in all seasons
- Bears increase movement rates when selecting habitat near roads but not near trails
- On regularly used trails, bears use trails sooner after the most recent human user than by chance


N
Legend
Spring Cameras
Low
Med
High
Habitat Quality
RSF Value
Non-critical
Secondary
Primary
Trails
Roads
Trails buffer (400m)
Park Boundary
Town of Banff
0 1 2 3 4 5
Kilometers
Lake Louise Area
0 1 2 3 4 5
Kilometers
Arnica and Twin Lake Trail
0 1 2
Kilometers


N
Legend
Spring Cameras
Low
Med
High
Habitat Quality
RSF Value
Non-critical
Secondary
Primary
Trails
Roads
Trails buffer (400m)
Park Boundary
Town of Banff
0 1 2 3 4 5
Kilometers
Lake Louise Area
0 1 2 3 4 5
Kilometers
Arnica and Twin Lake Trail
0 1 2
Kilometers

Conclusions

Conclusions

- Charismatic Carnivores:

  Cuddly Curiosities or Case studies of Conservation?

- False dichotomy?

BE WHAT YOU WANT TO BE

Questions?


Bushnell
Camera Name
30°F - 1°C
10-07-2014 07:42:28


Bushnell
Camera Name
41°F5°C
08-08-2014 07:31:02